

Index

- Abalones, 220
Abundance, fluctuations in, 68, 69
Acartia, fungus disease in, 150
Accessory substances, in sea water, 80
Achromobacter ichthyodermis, 159
Africa: east coast, 234; Southwest, 65
Agar, 275: chemical structure, 285; properties, 285; uses, 285
Aggregation habits, 100, 112
Aleem, A. A., 152
Alewife, pepper-spot disease in, 148
Algae (*see also* Seaweeds): as a cause of fish poisoning, 168; blue-green, 276; brown, 274, 276, 280; classification of, 274; composition of, 276, 277, 278, 287; filamentous green and blue-green, 70, 133, 151; green, 276; red, 275
Algin, uses of, 284
Alginates: properties of, 284; from seaweeds, 283; uses of, 284
Alginate acid: in brown algae, 276; definition of, 284, 286
Allee, W. C., 114
"Almost-species," 56
Ambergris, 263
Anadromous species, 134
Anatomy, 57, 59, 60: in study of environment, 97
Anchovies (*Engraulidae*), sporadic toxicity in, 166
Anglers (*Lophiidae*), toxicity among, 167
Animal exclusion theory, 78, 82
Animal feeds from plankton, 129
Annelids, dinoflagellates parasitic on, 159
Antarctic, 73 (*see also* Southern Ocean): Euphausiids in, 78; wealth of plankton in, 129; zoogeographical region, 236
Antibiotic activity in seaweeds, 281 ff.
Antibiotic substances in sea water, 81, 82
Aquarium experiments: difficulties with large animals in, 101; for studying behavior, 101
Aquiculture, 133 ff.
Arabian Sea, 65
Arafura Sea, 65
Arcachon Basin, France: description of aquicultural methods, 138; yields of fish in, 136
Arcisz, William, on fish poisoning, 168, 169
Arctic, wealth of plankton in, 129
Arctic zoogeographical region, 236
Artificial bait, 103, 104
Artificial light, behavior of animals in, 115
Artificial propagation, of seed oysters, 215
Artificial sea water, 79
Ascophyllum, 274: *A. nodosum*, 281
Atwater, W. O., and A. P. Bryant, 216
Augenkrankheit, in cod, 160
Australasian Antarctic Expedition, 237
Automatic undersea cameras, 115
Availability, fluctuations in, 68, 69
Azotic zone, at Walvis Bay, 177

Bacteria, 70, 81, 134: effect of copper on, 83; importance of, in marine ecology, 84; sulfate-reducing, 177
Bacterial diseases, 159 ff.
Bahamas sponge grounds, 211
Bainbridge, Richard, 78
Baird's beaked whale, 264
Bait: artificial, 103, 104, 205; cultivation of *Tilapia* for, 144
Baleen whale grounds: summer, 259; winter, 260
Baltic Sea, 65: occurrence of disease in copepods in, 150
Balut, 219
Barnacles: effect of red tide on, 178; as food, 224; as fouling organisms, 222, 224
Barnes, H., 115

- Barracouta, Australian (*Thrysites atun*), cnidosporidian disease of, 157
- Barracudas (Sphyraenidae), poisoning from eating, 166, 168
- Barton, Otis, 117
- Basking shark, 124
- Bathygrams, uses of, 111
- Bathypelagic fishes, 234
- Bathyscaphe, for behavior studies, 110, 118
- Bathysphere, 117
- Bay of Bengal, 65
- Bay of Fundy, mollusk poisoning in, 172
- Beach-landing vessels, 193
- Beaked whale, 258, 263
- Bears Bluff Laboratory, S.C., experimental brackish pond culture at, 136
- Bêche de mer*, 213
- Beebe, William, 117, 118
- Beever, C., 206
- Behavior, 59, 68, 98 ff., 294: research in, 119
- Behaviorisms, 110
- Benguela Current, 66, 177: wealth of plankton in, 129
- Bergius, E. George, 187
- Bergman, A. M., 160
- Bering, Vitus, 266
- Bermuda, 118
- Bikini Atoll, 243
- Bimini, Bahamas, 107
- Bioassay: of plankters, 130; in study of environment, 97
- Biochemical composition of marine organisms: cycles in, 70; sponges, 210; systematic analysis of, 130, 210; systematic studies, need of, 212, 213
- Biochemistry, 59, 135: need for fundamental research in, 294; in study of environment, 97
- Biological oceanography, provision for studying, 50
- Biological productivity, distribution of, 125
- Biotin, 124
- Black, W. A. P., 278
- Black pomfret, 107
- Black rot of kelp, 160
- Black Sea, sulfate-reducing bacteria in, 180
- Blackfish (*see* Pilot whale)
- Blastodinium*, 158
- Blue crab: fungus disease in eggs of, 154; intoxication of, 175
- Blue whale, 124, 257
- Bluefish, fluctuations in, 70
- Bombard, Alain, 122
- Bottlenose dolphin, 265: noises made by, 105
- Bottlenose whale, 258, 263
- Bottom, physical features observed by television, 116
- Bouchots*, 216
- Bowman's Bay, Washington, 160
- Brackish-water areas: destruction of, 134; misuse of, 134; production under cultivation of, 135 ff.
- Brackish-water farming, 133 ff.: research required to advance, 140, 145; species suitable for, 140; statistics on yield in several countries, 137
- Brackish waters: biological function of, 134; fertility of, 133
- Breder, C. M., Jr., 107
- Bristlemouths, 233, 238
- British Honduras sponge grounds, 211
- Brittle starfish, concentrations of, 114
- Brock, Vernon, 242, 243
- Bryozoans, 114
- Bull, H. O., 109
- Bumpus, Dean F., 84
- Bureau of Commercial Fisheries, Laboratories: Coral Gables, Fla., 116; Honolulu, 144; Pensacola, Fla., 76; Woods Hole, Mass., 116
- Burkenroad, Martin D., 90
- Butterflyfishes (Chaetodontidae), toxicity among, 167
- Button manufacture, 219
- Calanus*, fungus disease in, 150
- California: cabezone, 168; coast, hydrography of, 74; Cooperative Sardine Research Program, 298; Current, 72, 74; giant kelp, 274; gray whale, 258; kelp industries, 283; poisoning in marine invertebrates, 173
- Callinectes sapidus*, 224
- Camera, underwater, for behavior studies, 110, 114
- Cancer magister*, 224
- Captivity, effect of, on susceptibility to disease, 104
- Carbine, Fenton, 139
- Carbohydrates: in brown algae, 276; in seaweeds, digestibility of, 277
- Carcinoscorpius*, poisonousness in, 171
- Cardium*, 218
- Caribbean Sea: fish poisoning in, 167
- Carnivorous animals, effect on production of prey, 71
- Caroline Islands: fish poisoning in, 166; Japanese sponge culture in, 211
- Carotene, in marine algae, 278

- Carotenoids, 82: in plankton, 123, 124
 Carrageenin, 275, 285
 Cell physiology, 57
 Cellulose, in brown algae, 276
 Cephalopods, 220
 Chalinasterol, 212
 Chapelle, H. I., 187
 Cheloniidae, 254
 Chile, motorization of fishing craft in, 185, 194
 Chitin, possible uses of, 130
Chlorella, 281
 Chlorophyceae, 276
 Chopra, B. N., 137
 Christmas Island, fish poisoning in, 166
 Clams, 216: effect of red tide on, 178; as a food resource, 216; giant, 217; habitat of, 134; predators of, 217; toxicity in, 172; *Tridacna*, 217
 Clarke, George, 127
 Climate, and study of environment, 67
 Climatic change, effect on abundance of fish, 97
 Cnidosporeidians, parasitic forms, 155
 Cobb, M. C., 168
 Cockles, 216, 218
 Cod: oscillations in the Limfjord, 96; studies of behavior, 109; variation in broods, 69, 96
 Coelenterates, 212
 Coliform bacteria, effect of sea water on, 81
 Collier, Albert, 179
 Conditioned-response, techniques in behavior studies, 110
 Conditioned water, 102
 Conditioning: influence of, in behavior studies, 103; use of, in behavior studies, 109
 Conservation, 39 ff.: action, 48, 50; of fishery resources, 52, 87; philosophy of, 51
 Continental shelves: bottom fishes on slopes, 234; fish life, 230; mapped, 15
 Convergent zone, 75
 Copenhagen, W. J., 177
 Copepods: fungus disease in, 150; parasitic (*Lernaeocera branchialis*), 162
 Copper, effect on microorganisms, 83
 Coral reefs, fish life in, 234
 Coral Sea, 65: fishes of, 242
 Corals, 212
 Corlett, J., 128
 Correlations, as a technique for seeking causes of fluctuations, 69
Coscinodiscus concinnus, as a source of oil, 123
 Cousteau, Jacques-Yves, 118
 Crabs: behavior studied by television, 115, 116; as a cause of fish poisoning, 168, 172; cultivation in South Carolina, 136; Dungeness, 224; fisheries for, 224; giant crabs of North Pacific, 224; noises made by, 106; toxicity in, 172
 Crayfish fungus disease, 150
 Croakers: choruses during spawning migration, 106; tropical, 243
 Crustacea, 221: catch statistics, 210
 Cuba: deep-water fishing, 234; fish poisoning at, 166
 Cultivation: clams, 217; fish, 62; mussels, 216; oysters, 214; pearl oysters, 219; sponges, 211; trepang (sea cucumbers), 213; window shell, 217
 Culture: as a factor in improving fishing vessels, 185; as a factor in utilization of fishes, 235
 Currents, and red tides, 179
 Cushing, D. H., 128
 Cusk, fungus disease in, 149
 Cuttlefish, 220
 Cyanophyceae, 276
 Cycles, in biochemical composition, 70
 Cycles, seasonal: in fertility of surface waters, 72; in nutrients, English Channel, 80
Cyclothone, 233
 Cystitis, in fish, 155
 Cytology, in study of environment, 97
 D-glucose, from algae, 286
 Damas, D., 76
 Danish Biological Station, 96
 Darwin, Charles, 57
 Davis, F. M., 95
 Deck gear, problems requiring research, 197
 Deep scattering layer, 233
 Deep sea: fishes of, as potential food resources, 239; zoogeographic regions of, 238
 Demersal animals, study of distribution of, 113
 Demes, 55
 Demoiselles (Pomacentridae), toxicity among, 167
 Denmark, oysters, 77
 Depth finders for fishing vessels, 202
 Dermochelyidae, 254
Desulphovibrio desulphuricans, 177
 Diatoms, 78, 128: dinoflagellate parasitic on, 159; fungi parasitic on, 151; significance of, in marine ecology, 83
 Dickson, W., 204

- Dinoflagellates, 83 ff.: cause of poisoning, 168, 171; changes during poisonous phase, 172; effect of copper on, 83; parasitic, 158, 159; plasmodium stage, 158
- Diplobacillus*, 160
- Discovery, 127
- Disease, 8, 70, 158: a cause of fluctuations in abundance, 148; a factor in marine ecology, 147; a problem in aquarium and tank studies, 104
- Distribution, charts of, 59
- Diurnal movements of herring, 111
- Diurnal rhythms in behavior, 101
- Divergences, 72: and distribution of whales, 258; at the equator, 75
- Diversification of fishing: advantages of, 88; modifications of vessels required for, 199
- Dogfish, in industrial fish fishery, 97
- Dogger Bank, 95
- Dolphin (fish), in oceanic currents, 239; as subjects of tank experiments, 102, 105
- Dolphin (mammal), 258, 264
- Dove Marine Laboratory, Cullercoats, 109
- Drew, K., 288
- Dry Tortugas (Florida), 242
- Dugong, 266, 267
- Dunbar, M. J., 236
- Dynamics of ecological systems, 94
- East Anglia, behavior of herring at, 112
- Echinoderms, 213: as a cause of fish poisoning, 169
- Echo sounders: for behavior studies, 110, 111; for locating fish, 111
- Echo sounding, possible use by deep sea fish for orientation, 107
- Ecological conditions, normal vs. abnormal as the stimulus of research, 94
- Ecological principles, 87, 91
- Ecological system, 147: as a focal point of research, 97
- Ecology, 58, 147: difference between sea and land, 232; of great depths, 291; support for studying, 50
- Economic activity, distribution of types, 21
- Economic changes, resulting from expanding fisheries, 186
- Economic problems: influence on utilization of fishes, 235; involved in mechanization of fishing fleet in Chile, 194
- Economics, 7, 47, 51, 53, 93, 186, 187, 235
- Ecosystem, 88
- Ectocrines, 77
- Ectrogella*, 151
- Eelgrass (*Zostera marina*): ecological significance of, 153; wasting disease of, 152 ff.
- Eelpout (*Zoarces viviparous*), 96: in industrial fish fishery, 97
- Eelpouts (Zoarcidae) in Antarctic, 236
- Eels, red disease of, 160
- Electricity, use of in fishing, 203 ff.: for menhaden, 204; for tuna, 204
- Electrolysis, a problem in fishing vessel construction, 195
- Electronic equipment for fishing vessels, 202
- Elements in seaweeds, 278
- Embryology, 57
- Emerson, George A., 181
- Enemies, effect on mortality, 68, 69
- Engineering research required for vessel improvement, 195 ff., 198, 205
- Enteritis in fish, 157
- Entomology, 135
- Environment, 62: chemistry in study of, 97; definition as used in this book, 63; effect of variations on fish stocks, 70; effect on characteristics of populations, 57; effect on fishery stocks, 49; influence on survival of young, 44
- Environmental dynamics, 85
- Environmental limits of distribution, 53
- Environmental research, 87: laboratories for, 85; questions for, 67; scope of a research program in, 71; subjects of study in, 67
- Environments: interaction of, 64; need for study of, 50
- Epidemics, 69, 70
- Equator, divergence and upwelling at, 75
- Equatorial current systems, 66; fishery potentialities of, 291; wealth of plankton in, 129
- Estuaries, tropical, 243
- Euglena*, associated with red water in India, 176
- Euphausiids (*see also* Krill): reciprocal effect on phytoplankton, 78; vitamin A in, 124
- Europe, mollusk poisoning in, 172
- Eurytemora hirundoides*, fungus disease in, 150
- Euthynnus yatto*, 102
- Exchange between deep and surface water, 72

- Exploitation of fishery stocks, effect of, 40, 43, 45
- Exploratory fishing, 53, 62
- Falkland Islands, fishing at, 237
- False killer whale, 264, 266
- Fanning Island, occurrence of fish poisoning at, 168
- Fastenings, need for research to improve fastenings in vessels, 193
- "Father and Son" system of propulsion in fishing vessels, 196
- Faunal changes, 95, 97
- Feeding habits, 100: experimental study of, 102
- Feldmann, Jean, 287
- Fertile areas, distribution of, 37
- "Fertile water," 80
- Fertility of the sea, 70 ff.
- Fertilization: of brackish ponds, 146; of surface water, 72
- Fertilizer, invertebrates as a source of, 210
- Field studies of behavior, 102
- Filefishes (Monacanthidae), toxicity among, 167
- Fin whales, 258
- Firth, Raymond, 184, 186
- Fish, Charles J., 168
- Fish: cultivation of, in South Carolina, 136; effect of red tide on, 178; farming, 62; intoxication of, 176
- Fish, Marie, 106
- Fish flesh, extracts of, for attracting tuna in experiments, 102
- Fish jubilee: in Alabama, 176; in India, 176
- Fish meal, technological problems in producing, 291
- Fish poisoning: theories on causes of, 168, 169; symptoms of, 166
- Fish production, 7, 242
- Fishery: industries, 187; management, 88; research, 8, 48, 49; statistics, 239
- Fishes, 226 ff: dependence on continental shelves, 230; factors determining distribution, 231; fishermen's knowledge of, 229; kinds used commercially, 228; number of known species, 229; size, 231
- Fishing: for fish and for plankton, compared, 128; gear, 116, 203, 294; grounds, 36; regulation of, 41, 42, 47, 48, 93
- Fishing rate: control of, 53; effect on rates of birth, death, and growth, 46; relation to yield, 44
- Fishing vessels: evolution of, 188; high cost, 200; improvement of, 182 ff., 194, 195, 295; maintenance problems, 195; materials for construction, 192; radar, 202; radio, 203; size categories, 103, 188; sociological and technical problems in Chile, 195; studies required for, 188, 189, 191, 192
- Flagellates, 78, 83
- Flatworms, parasitic, 161
- Flora and fauna, composition change, 95, 97
- Florideae, 288
- Flounder, yellowtail, 97
- Flounders: changes of environment with age, 64; fungus disease in, 149
- Fluctuations in abundance, 8, 11, 40: causes of, 68, 163; need of research to understand causes, 294; variation in, 69
- Foerster, R. E., 160
- Food and Agriculture Organization, 4, 7
- Food chain (*see also* Food pyramid), 60, 83
- Food pyramid, 71, 83, 231
- Formosa: fishing for milkfish fry, 145; milkfish ponds, 139; yields of fish in brackish areas, 136
- Free diving for underwater observations, 117
- Friedrich, H., 130
- Froude, William, 189
- Fucoidin: in brown algae, 276; preparation of, 286
- Fucose, L-, from algae, 286
- Fucosterol, preparation from algae, 286
- Fucus*, 274
- Fugu*, 167
- Fungi, pathogenic, 60, 70 ff.: on algae, 151; copepods, 150; diatoms, 151; eelgrass, 153; eggs of marine animals, 154; fishes, 148; rotifer, 151; sponges, 153
- Fungus disease, 148 ff.
- Gaffkya*, 159
- Galathea* (Danish research ship), 178
- Galathea* (genus of squat lobster), disappearance of, about Plymouth, 70
- Galtsoff, Paul, 178
- Gas bladder as a sound-producing organ, 106
- Gear, fishing, improvement of, 182 ff.
- Gelidium*, 285
- Genetics, 8, 57, 58, 59, 135, 215, 287
- Geography of fish distribution, 235

- Geological characteristics of ground inhabited by demersal animals, 113
 Geology in study of environment, 97
 German Hydrographic Office, 123
 German State Biological Institute, Heligoland, 122
 Glucose, D-, from algae, 286
 Gobies: effect of cod on abundance in Limfjord, 96; fishery for, in Philippine Islands, 227
Gonyaulax: catenella, 172; *tamerensis*, 172
 Goose barnacle (*Mitella pollicipes*), 224
 Goosefish in industrial fish fishery, 97
Gracilaria, 285
 Grand Banks hydrography, 73
 Grand Turk Island, fish poisoning at, 166
 Grenadiers (Macrouridae), 239
 Griffin, Donald, 107
 Gulf of Bothnia, 65
 Gulf of Maine, 68; circulation of water in, 75; distribution of plankton in, 75
 Gulf Stream, 73
 Gunther, E. R., 78
Gymnodinium brevis: artificial culture of, 179; cause of red tide and mass mortality, 178; phases of, 179; sensitivity to copper, 83; sensitivity to ions of heavy metals, 179
Gymnodinium galathea, cause of fish kills in west Africa, 178
Gymnodinium splendens, a benign form, 179
Gymnothorax, occurrence of fish poisoning in, 168
 Habits of marine food fishes, distribution of knowledge about, 249
 Haddock, 44, 47; fungus disease in, 149
 Hake: fungus disease in, 149; red, in industrial fish fishery, 97
 Halibut, cnidosporidian disease of, 157
Haliotis, 220
 Halstead, Bruce W., 167
 Hanson, H. C., 200
 Hardy, A. C., 78, 122, 128, 130, 200
 Hardy plankton recorder, 131
 Hart, T. J., 129
 Harvey, H. W., 79
 Hasanuddin Saanin Sutan Larangan, 137
 Havinga, B., 130
 Hawaii, coral reef fishes, 242
 Heligoland, German State Biological Institute at, 122
 Hemorrhagic septicemia in fish, 160
 Hepatitis, in fish, 157
 Herald, Earl S., 243
 Herbivorous animals: effect of phytoplankton on, 71; fishes, 232
 Heredity and environment, effects on characteristics of populations, 57
 Herring: behavior of schools, 111; changes of environment with age, 64; disease in, 148, 160; diurnal movements of, 111; effect of *Phaeocystis* on, 78; fluctuations in availability, 69; as harvesters of plankton, 128; as raw material for fish meal, 291; response to light, 112, 113; vertical migration, 112
Heterochordaria abietina, 275
 Heyerdahl, Thor, 122
 Hickling, D. F., 138
Hippopus, 217
 Histology, in study of environment, 97
 Hiyama, Yoshio, 107, 168
 Holothurin, effect on sarcoma, 171
Homarus, 223
 Hooper Foundation, 173
 Horizontal movement of sea water, biological significance of, 73
 Horseshoe crab, poisonousness in, 171
 Hsiao, Sidney, 104
 Human populations, map of distribution of, 17
 Humboldt Current, wealth of plankton in, 129
 Humpback whale, 258
 Hydrogen sulfide, associated with red tide, 176, 177, 179, 180
 Hydrographic instruments, accuracy required for biological studies, 110
 Hydrography: in relation to fluctuations, 163; in study of environment, 97
 Hydrophone, 106
Hymenopenaeus robustus, 222
Ichthyosporidium, 148 ff.
 Immunology, 58
 India, vessels powered by sail and by motor compared, 184
 Indian Ocean, 65
 Indicator species, 80
 Indonesia: change in peasant society, 187; use of noise to attract fish, 107; yields of fish in brackish ponds, 136
 Indonesian Sea, 65
 Indo-Pacific countries, cultivation of brackish waters in, 134
 Indo-Pacific Fisheries Council, 146, 301
 Indo-Pacific zoogeographic region, 235, 236
 Industrial fish fishery, possible effect on yellowtail flounder, 97

- Infant mortality of marine animals, causes of fluctuations in, 163
 Inshore environment (*see also* Brackish waters), as habitat of oysters, 145
 Instability of supply (*see* Fluctuations in abundance)
 Insurance cost, for fishing vessels, 202
 Interaction among species, 92, 96
 Intergovernmental cooperation in fishery research and conservation, 49
 International Commission for Northwest Atlantic Fisheries, 241
 Intestinal flora for digesting algae, 277
 Intoxication of marine organisms: Malabar Coast, India, 176; Mobile Bay, Ala., 175
 Invertebrate marine animals, 209 ff.
 Iodine from seaweeds, 282
 Ipon fishery, 227
 Irish fishing boats, layout, 199
 Irish moss (*Chondrus crispus*), 285
- Jack family (Carangidae): as experimental animals in tanks, 102; as raw material for fish meal, 291
 Jacks (*Caranx*), identification of, 55
 Jackson, Philip, 127, 130
 Japan: cultivation of red algae, 286; fish poisoning in, 167; hydrography of, 73; mollusk poisoning in, 172, 173; research to improve fishing vessels, 193
Jasus, 223
 Java: marine fish ponds in, 138; shrimp culture in, 142
 Jellyfish (*Rhopilema esculenta*): as food, 168, 212; as shelter for young fish, 212
Jenkinsia, behavior of, 107
 Jet propulsion for fishing boats, 196
 John Dory (*Zeus capensis*), cnidosporidian disease of, 157
 Jordan, David Starr, on causes of fish poisoning, 168
 Juday, Chancey, 128
- Kalle, K., 123
 Kellogg, W. N., 105
 Kelp (*see also* entries under Algae and Seaweeds): burning for production of chemicals, 283; diseases of, 160; meal for animal feeds, 280
 Kerr, Sir John Graham, 122
 Ketchum, B. H., 81
 Killer whale, 264: false, 264, 266
 Kohler, Robert, 105
- Kon, S. K., 124
 Kort nozzle, 196
 Krill, vitamin A in, 124: as food of fish in antarctic, 236
 Krogh, August, 79
 Kuroshio Current, 73
- L-fucose, from algae, 286
 Lab-lab, 141, 146
 Laboratories: for marine research, 28, 65, 85, 164; for studies of behavior, 102
 Labrador current, 73
 Labridae, occurrence of toxicity in, 168
Labyrinthula, as cause of eelgrass disease, 152
Lagenidium callinectes, 154
 Lamellibranchs, 216
Laminaria, mineral content, 277
 Laminarin, in brown algae, 276: preparation of, 286
 Lanternfishes (Myctophidae), 233: oil content, 238
Laticauda colubrina, 245
 Laver, cultivation in Japan, 286
 Layout of fishing boats, problems requiring research, 198 ff.
 Leeches, parasitic, 161
Lernaeocera branchialis, 162
 Lerner Marine Laboratory, 107
 Life history studies required in environmental research, 67
 Light: abnormal behavior in artificial, 115; effect on feeding behavior of fish, 104; effect of intensity of light on behavior, 113; penetration of, 72; response of herring to, 112; response of pilchard to, 112
Limacina retroversa in Gulf of Maine, 76
 Limfjord: oysters in, 77; periodic surveys in, 96
 Limpets, 219
 Little tunny, as subjects of tank experiments, 102
 Lobsters, 223: bacterial disease of, 159; behavior studied by television, 115; fisheries for, 223
 Loggerhead sponge, 211
 Longley, W. H., 242
 Long-snouted dolphin, reactions to noise, 105
 Loran, for fishing vessels, 202
 Lowestoft, Fishery Laboratory, 123
 Lucas, C. E., 82
 Lunz, Robert, 136
 Lymphocystis, 161

- Mackerel: fungus disease in, 149; relation of distribution to plankton production, 76; snake mackerel, 167
- Macrouridae, 239
- Maine, mollusk poisoning, in, 172
- Malabar Coast, India, intoxication of marine organisms, 176
- Malaya: change in peasant society, 187; fisheries, 184
- Mammals, 256 ff.
- Man: as an element in an ecological system, 89; as the only cause of depletion, 92
- Manatees, 266
- Manganese in diatom cultures, 80
- Mangrove swamps, 139
- Mannitol, in brown algae, 276: preparation of, 286
- Marianas Islands, fish poisoning in, 166
- Marine animals, invertebrate, 209 ff.
- Marine Biological Laboratory, Plymouth, 114
- Marine laboratories, regional, 86
- Marine organisms, fluctuations in quality, 69
- Marineland, Florida, 105
- Marlin, 291
- Marr, James W. S., 128
- Marshall, N. B., 237
- Marshall, S. M., 130
- Marshall Islands, fish poisoning in, 166, 169
- Matsumo, 275
- Matsuo, R., on fish poisoning, 168
- Maximum sustained yield, 50
- Mechanical whale, 129
- Mechanisms of environmental systems, 91
- Mechanization of fishing boats: in Chile, 185, 194; in India, 197; problems of, 185 ff., 194
- Mediterranean Sea, 238
- Menhaden, variations in oil yield, 70
- Merchant shipping, distribution of world fleets, 23
- Mermaids, identified with sirenians, 266
- Mesoplon*, 264
- Microbiology, 84, 135
- Migration habits, 101
- Milkfish (*Chanos chanos*): cultivation of, 139, 141; fishing for fry, 145; in Indonesia, 141; problems for research, 145
- Minerals in seaweeds, 277
- Mitchell, R. L., 278
- Mobile Bay, Alabama, mass intoxication of marine organisms, 175
- Model studies: of fishing gear, 203; vessel, 189, 192, 199
- Mollusks, 214: catch statistics, 210; poisoning, 171 ff.; potential value of, 214
- Moray eels (*Muraenidae*), toxicity among, 167
- Mortality, mass: as a cause of disappearance of stocks, 70; resulting from red tides, 171; at Walvis Bay, 177; of window shell, 218
- Mortality, natural, 68 ff.: disease as a cause of, 147 ff.; rate, 54, 68, 163
- Mother-of-pearl, 218
- Mugil cephalus*, suitable for cultivation, 140
- Mulletts (*Mugilidae*), suitable for cultivation, 140
- Mummichog, pepper spot disease in, 148
- Munda*, disappearance of, 70
- Munition dumping, as a cause of fish poisoning, 168
- Muraenolepis*, 236
- Museum: collections, 58; research, 53, 57, 58, 59
- Mussels, 216: toxicity in, 172
- Myctophidae, 233: as possible raw material for fish meal, 291
- Myers, G. S., 235
- Mytilus*, 216
- Myxobacteria, 160
- Narragansett Marine Laboratory, 106
- Narwhal, 258, 264, 266
- National Antarctic Expedition, 237
- Natoena Islands, use of noise to attract sharks, 107
- Natural history, 58, 93, 102, 107: museums, condition of, 59
- Naval architects, 205
- Nematocysts of coral polyps, as a cause of poison in fish, 168
- Neothunnus macropterus*, 102
- Nephritis, in fish, 157
- Nephrops*, 223
- New Caledonia: coral reef fishes, 242; poisonous fishes, 169
- New England Banks, 65
- New Zealand, 241
- Niacin, in plankton, 124
- Nigrelli, Ross, 155, 156 ff., 158
- Noctiluca*: associated with red water at Walvis Bay, 178; as a precursor of poison water in India, 176
- Noises, made by sea animals (*see* Sounds)
- Norman, J. R., 168
- Norris, Earl R., 278

- North Atlantic Ocean, 65: zoogeographic region, 237
 North Pacific zoogeographic region, 237
 North Sea, 65, 95: fisheries, 240; standing crop of zooplankton in, 124
 Northern sea cow, 266
 Norwegian Sea, 65
Notothenia coriiceps, 237
 Nototheniidae, 236
 Nova Scotia, density of rockweed, 274
 Nucleosides in sponges, 212
 Numbers of animals, effect of disease on, 70
- Ocean sunfish, 232
 Oceanaria, for studies of behavior, 105
 Oceanic currents, as environment of tunas, swordfish, etc., 239
 Octopus, 220
 Oil in plankton, 123
 Old fish, value of conserving, 44
Oodinium ocellatum, 159
Ophioderma, aggregations of, 114
 Ophiuroids (*Luidia ciliaris*), observed by television, 116
 Ordal, Erling, 160
 Organic substances in sea water, 68, 77, 79 f.: and red tide, 179
Origin of Species, 57
 Orr, A. P., 130
 Oscillations in numbers of organisms, 68, 89, 96: need of research to understand causes, 294
 Osorio-Tafall, B. F., 188
 Overexploitation of mammals, 257
 Overfishing, 93: as a cause of disappearances, 70, 89; of clams, 217; yellowtail founder, 97
 Oyashio Current, 73
 Oysters, 214: changes of environment at different stages, 64; cultivation of, 136, 143, 145, 214; differences in growth between localities, 76; distribution, 214; effect of red tide on, 178; fluctuations in setting, 215; habitat of, 134; pearl, 218; toxicity in, 172; variation in number setting, 77
- Pacific fishes, occurrence of disease in, 150
 Pacific sardine, disappearance of, 74
 Pacific Sealing Convention, 269
 Panamanian zoogeographical region, 235, 236
Pandalus borealis, 222
Panulirus, 223
 Parasitic worms, 60, 161
- Parrotfishes (Scaridae), toxicity among, 167, 168
 Patagonian zoogeographical region, 238
Pecten, 218
Pelamydrus platurus, 245
Pelvetia, variation in mineral content, 277
Penaeus duorarum, 222
 Peneidae, 142
 Pepper-spot disease, 148
Peridinium, 158
 Periwinkles, 219
 Permanent Commission, for regulating North Sea fishery, 240
 Peru current, 66
 Petrel, relation of distribution to plankton production, 76
Phaeocystis, 77
 Pharmaceutical value, possibilities of, in invertebrates, 210
 Pharmacologically active substances in sea water, 181
 Philippines: brackish water fish farming in, 139; cultivation of prawns in, 143; fish poisoning in, 167; fishery for milkfish fry, 141
 Phosphates, concentration of, 84
 Photography: assessing abundance of algae by aerial, 274; undersea, as a research technique, 115, 203
 Photonegative response, 113
 Photopositive response, 113
 Photosynthesis, 71, 72, 84
 Physiological effects, of organic substances, 83
 Physiology, 57, 58, 59: in study of environment, 97
 Phytoplankters, effect on animals, 83
 Phytoplankton, 71
 Piccard, Auguste, 118
 Pilchard (*see also* Sardine, Pacific): diseases of Pacific pilchard, 160; response to light, 112
 Pilot whale, 264, 265
Pinctada, 218
Placuna placenta, 217
 Plankton: chemical composition of, 123; cultivation of, 63, 131; as food for domestic animals, 129; as food for human beings, 122; harvesting, 121 ff., 128, 130; research on, 130, 131
 Plankton-feeding fishes, 232
 Plymouth Laboratory, 80
 Poisons: in echinoderms, 213; in fishes, 165 ff.; in marine organisms, 165 ff., 293; in mollusks, 171 ff.; in plankton, 173; properties of, 169, 173; research

- Poisons—*continued*
 required to study, 170; in sea urchins, 213; in starfish, 213; tolerance to, 174
 Pomfret, 291
 Pompanos (Carangidae), sporadic toxicity in, 166
 Pond culture, research laboratory for, 146
 Population: dynamics, 17, 45, 68; genetics, 58
 Populations, communal, 56: differences among, 56
 Porcupine fishes (Diodontidae), toxicity among, 167
Porphyra, 277
 Porpoise, 258, 264, 265: effect of red tide on, 178
 Potash, from seaweeds, 282
 Potential yield, estimates, 288 ff., 292: research required to achieve, 293 ff.
 Prawns (*see also* Shrimps), 222: changes of environment at different developmental stages, 64; cultivation of, 136
 Predators, 49, 54, 68, 217: control of, in brackish enclosures, 146
 Pribilof Islands: fur seals, 268; sea lions, 267
 Propeller, controllable pitch, 196
Prorocentrum micans, 173
 Protein: in brown algae, 276; in plankton, 123; in seaweed, 277; starvation, distribution of, 19
 Protozoa, 82: parasites, 155; pathogenic, 70, 156
 Pteropods, dinoflagellates parasitic on, 159
 Puerto Rico, fish poisoning at, 166, 168
 Puffers (Tetraodontidae): detoxication of flesh for food, 167; toxicity among, 167
Pyrodinium phoneus, 172
- Queensland, coral reef fishes, 242
 Qureshi, M. R., 187
- Radar for fishing vessels, 202
 Radio equipment for fishing vessels, 203
 Rae, K. M., 130
 Rain, associated with red tide, 179
 Ray, S. M., 179
 Reactions of fishes to unfamiliar stimuli, 101
 Red disease of eels, 160
 Red Sea, 65
 Red sponge (*Microctona prolifera*), 211
 Red tide, 171, 175 ff.: effect on people, 178; effect on sea animals, 178; factors influencing, 179; hydrogen sulfide associated with, 176, 177, 179, 180; sequence of events in, 180; Walvis Bay, Africa, 176; west coast of Florida, 178
 Redfield, Alfred, 75, 76
 Reef coral, distribution of, 245
 Regulation of fishing, 93: history of, 41; information required for, 48; methods of, 42, 47; testing of, 47
 Religion, as a factor in changing fishing gear and practices, 185, 186
 Reproduction rate, 54, 68
 Reptiles, marine, 245
 Research programs, rate of progress in, 94
 Response, photonegative and photopositive, 113
 Restriction of fishing, fear of, 93
Rhizosolenia, effect on marine animals, 81
 Rhythms in abundance, 68: of diatoms, influence of disease on, 151
 Riboflavin in plankton, 124
 Richardson, I. D., 111, 112
 Rickettsiae, 70
 Right whale, pygmy, 257
 Riley, Gordon, 84
 Ringhaver, L. C., 200
 Rockfishes (*Sebastes*), for behavior studies, 110
 Rockweed, 274
 Rorqual whale, 258
 Rosenfeld, William, 81
 Rotifers: feeding on fungus spores, 152; parasitized by a fungus, 151
 Roundworms, parasitic, 161
- Sagitta*, as indicator species, 80
 Sailing craft, advantages and disadvantages, 184
 St. Thomas, fish poisoning at, 166, 169
 Saipan, fish poisoning at, 168
 Salinity, effect on behavior, 109
 Salmon, 134: diseases of, 160, 161
 Samoa, fish poisoning in, 168
Saprolegniaceae, 150
 Sardine, Pacific (pilchard): diseases of, 160; fungus disease in egg of, 154; possibility of fungus disease in, 150; quantity of food consumed by, 124
 Sargasso Sea, observations from bathysphere in, 118
Sargassum, 274
 Savage, R. E., 77
 Scallops: as a food resource, 216, 218; toxicity in, 172
 Scaridae, occurrence of toxicity in, 168

- Scattergood, Leslie, 149
 Schistosomiasis, transmitted by gastro-
 pods, 219
 Schooling behavior, study of, 108, 111
 Schultz, Leonard, 243
 Shuster, W. H., 137
 Scotia Sea, 65
 Scotland, density of kelp, 274
 Scripps Institution of Oceanography, 81,
 159
 Scuba, for undersea observations, 117
 Sculpin, in industrial fish fishery, 97
 Sea anemones as food, 212
 Sea bass: effect of different fishing rates
 on yield, 44; sporadic toxicity in, 166
 Sea cucumber (*Actinopyga agassizi*),
 poisonousness of, 171
 Sea cucumber (*Cucumaria minata*), for
 clam chowder, 213
 Sea farming, 8, 53, 135, 136 ff.
 Sea lettuce (*Ulva*), 277: antibiotic activ-
 ity in, 282
 Sea lions, 267
 Sea otters, 271
 Sea raven, in industrial fish fishery, 97
 Sea robin, in industrial fish fishery, 97
 Sea snail: in antarctic, 236; fungus dis-
 ease in, 149
 Sea snakes (Hydrophiidae), 245
 Sea urchins, 213: depletion of, 70; as
 food, 213
 Sea vegetables, 276
 Sea water, horizontal movement of, 73
 Seals, 267 ff.: crab-eater, 236; crested,
 270; eared, 267; elephant, 270; fur,
 268; harbor, 270; harp, 270, 271;
 ringed, 270; toxicity in, 170; true seal,
 270
 Seaweeds (*see also* entries under Algae),
 273 ff.: composition, 276; density, 274;
 digestibility, 277, 280; as feed for do-
 mestic animals, 280; as fertilizer and
 soil conditioner, 281; manurial value,
 281; red, 285; research on, 287; as a
 source of antibiotics, 281; uses, 275;
 water content, 287
 Seed oysters, need of artificial propaga-
 tion, 215
 Selective breeding, 8, 145: of clams, 217;
 of oysters, 216
 Selective fishing: to control balance of
 populations, 63; genetic effect of, 57
Sepia, 221
 Setna, S. B., 184, 197, 201
 Sette, Oscar, 75
 Shad, 134
 Sharks, basking and whale, 232
 Shrimps (*see also* Prawns), 142, 222:
 culture of, 142; noises made by, 106
 Shropshire, R. F., 128
 Shuster, W. H., 137, 142
 Silica, in diatom cultures, 80
 Simeon, Mary K., 278
 Sinderman, Carl, 149
 Siphonophores, dinoflagellates parasitic
 on, 159
 Sirenians, 266
 Skates, in industrial fish fishery, 97
 Smell, as means of detecting food, 102,
 104
 Smith, Otis, 204
 Snails: as a food resource, 219; preda-
 ceous, 217, 219
 Snake mackerel (Gempylidae), toxicity
 among, 167
 Snappers (Lutianidae), sporadic toxicity
 in, 166
 Soda from seaweeds, 282
 Solar radiation, 84
 Sommer, H., 173
 Sonar, for behavior studies, 110
 Sound-making mechanisms in fishes, 106
 Sounds, made by sea animals, 106, 107
 South Africa, 241
 South African zoogeographical region,
 238
 South America, 66, 234: hydrography of,
 72
 South Australian zoogeographical region,
 238
 Southern Ocean, 66
 Spärck, R., 77
 Sparrow, F. K., 151
 Spawning: habits, 100; relation to sus-
 taining abundance, 42, 43; season, ef-
 fect of fishing during, 92; stock, rela-
 tion to number of offspring, 92
 Species: composition of food fish faunas,
 251; concept of, 54 ff.; definition of,
 55; of fishes, 247; importance of pre-
 cise recognition, 54 ff.; study of, 53 ff.,
 287, 293
 Sperm whales, 258, 263: distribution,
 261, 262, 291, 292
 Spermaceti, 263
 Spiny lobster, noises made by, 106
 Sponge: fisheries, 211; wasting disease
 of, 153, 211
 Spongiophaga, 153
 Sprats, schooling behavior of, 111
 Spraying water to attract fish, 107
 Sproston, Nora, 149
 Squat lobsters, fluctuations in, 70
 Squids, 220: as food of whales, 263; as

- Squids—*continued*
 hunters, 71; in Pacific equatorial current system, 291
Squilla, noises made by, 106
 Starfishes, 60
 Statistics, fish, 239
 Steller, Georg, 266
 Sterols, 82
 Stockfish (*Merluccius capensis*), cnidosporean disease of, 157
 Stommel, Henry, 84
 Submarine observation chamber, 119
 Sulfate-reducing bacteria, and red tide, 177, 180
 Sulfides, and *Gymnodinium brevis*, 179
 Surgeon fishes (Acanthuridae), toxicity among, 167
 Surmulletts (Mullidae), sporadic toxicity in, 166
 Swamps, and red tide, 179
 Swedish South Pole Expedition, 237
 Swim bladder, as a sound-producing organ, 106
 "Swims," 112
 Swordfish: as hunters, 71; in oceanic currents, 239
 Symbiotic substance, 81, 82
 System, definition of, 88
- Taft, Charles H., 181
Tai-aic (food of young milkfish), 141
 Tait, John, 72
Tambaks, 138
 Tank studies of behavior: advantages, 108; pitfalls, 104, 108
 Taste, as means of detecting presence of food in water, 102
 Taxonomy, 53, 57, 58, 97, 293
 Taylor, Harden F., 89
 Technology, 7, 187, 210, 294
 Television camera, for undersea studies, 110, 115 ff.
 Temperature, 84: effect on behavior, 108, 109; effect on incidence of disease, 150, 160; and red tide, 179
 Tester, Albert, 103
 Tetramethyl ammonium salt in marine organisms, 173
 Textiles made of seaweed products, 284
 Thompson, S. Y., 124
 Threadfishes, 243
 Tide-pool fishes, 101
Tilapia, cultivation of, 144
 Tinian Islands, fish poisoning at, 168
 Toadfish, 97, 106
 Tokai Regional Experimental Station, Japan, 203
- Toothed whales, 258
 Townsend, C. H., 291
 Toxic properties, in plankton organisms, 78
 Trace elements, 68, 80, 97: in seaweed, 278
 Transportation facilities, distribution of, 25
 Trash fish, 97
 Traung, Jan-Olof, 185, 190, 200
 Trawlers, criteria for good design, 191
 Trepang, 213
Trochus, 219
 Triggerfishes (Balistidae), sporadic toxicity among, 167
 Tropics, compared with northern latitudes in wealth of fish life, 233
 Trunkfishes (Ostraciidae), sporadic toxicity among, 167
 Tuberculosis in fish, 159, 161
 Tuna: clippers, experience in designing, 198; in oceanic currents, 239; in Pacific equatorial current system, 291, 292; as a subject of tank experiments, 102; *Tilapia* as bait for, 144; tuna flesh extract for attracting, 103
 Tung-pai Chen, 137, 139
 Tunicates: as food, 225; parasites of, 159
 Turtles, 254: effect of red tide on, 178; toxicity in, 170
 Tyrrell, John, 199
 Tyrrhenian Sea, observations from bathyscaphe in, 118
- Ulva*, 276
 Underwater camera for behavior studies, 110, 114
Unicapsula thryssites, 157
 United States Fish and Wildlife Service (see Bureau of Commercial Fisheries, Laboratories)
 United States Navy Hydrographic Office, 301
 Upwelling, 72: and distribution of whales, 258
 Ursin, Erik, 95
- Vallin, Sten, 150
 Van Weel, P. B., 102
 Variation: in antibiotic activity, 282; in biochemical composition of marine organisms, 70; in chemical composition of seaweeds, 287; in exploitation of the sea, 12; in fertility, 71; geographic, in study of the sea, 13; in human cultures, 11, 12; in human populations, 11; in incidence of starvation, 19; in

- intensity of fertilizing processes, 73; in production of phytoplankton, 71; in set of oysters, 77; in size of year broods, 69; in vitamin C content of seaweeds, 278
- Venerupin, 173
- Vertical movement of sea water, biological significance of, 73
- Vertical turbulence, 84
- Vessels, fishing (*see also* Fishing vessels): improvement of, 182; model studies, 189
- Vevers, Henry, 114
- Vibration, in fishing vessels, 196, 197
- Vibrio, cause of disease in fish, 160
- Vibrio anguillarum*, 160
- Vidicon television chain, 116
- Virgin fishery stocks, problems of exploiting, 40
- Virgin Islands, occurrence of poisonous fish, 168
- Virus diseases, 161
- Vision in fishes, 101: function of, in feeding, 104
- Vitamins: in Euphausiids, 124; in livers of bears and seals, 170; in marine algae, 278; in plankton, 124; in seaweeds, 277, 278
- Wahoo, 291
- Walrus, 269
- Walvis Bay, S. W. Africa, red tide in, 176 ff.
- Washington State Department of Fisheries, 160
- Weather: and fishing, 30-33; study of, in fishery research programs, 68
- West African zoogeographic region, 235
- West Indian zoogeographic region, 235, 236
- Western Africa, hydrography of, 72
- Whales, 257, 258, 263, 264: baleen, 257; as harvesters of plankton, 128, 129; meat, 264; sperm, 258, 261, 262, 263, 291; white, 264, 265, 266
- Whelks, 219
- Whiting, in industrial fish fishery, 97
- Williams, Hal B., 278
- Wilson, Douglas, 81
- Wilson, W. B., 179
- Wimpenny, R. S., 123, 130
- Winches, research required to improve, 197
- Wind, and red tide, 179
- Window shell (*Placuna placenta*), use of as windowpanes, 217
- Winter flounder, pepper-spot disease in, 148
- Wood-boring isopods, 222
- Wrasses (Labridae), toxicity among, 167, 168
- Wun (milkfish ponds), 139
- Ziener, Paul, 185, 195
- Zimmer, Hans K., 188, 194
- Zoarces viviparous*, 96
- ZoBell, Claude, 81, 84, 154
- Zoogeographic regions, 235, 236, 237, 238
- Zoology, in study of environment, 97
- Zwolsman, W., 201