infection of *Ascarophis* and *Corynosoma* and of the commensal *Histriobdella* reported from American lobsters of the Mid-Atlantic Bight, southern New England waters, and the Gulf of St. Lawrence, are not large and could be attributed to differences in sample sizes or season of sampling. Peculiarly, cysts of the sporozoan *Porospora* sp. were not seen in Mid-Atlantic Bight lobsters, but occurred in most lobsters in the Gulf of St. Lawrence (Montreuil 1954; Boghen 1978) and were reported by Uzmann (1970) from southern New England waters. Cysts of the trematode *Stichocotyle* sp. were reported by Nickerson (1895) from Penobscot Bay, ME, and from lobster dealers in Boston, MA; by Linton (1940) from an unstated region, probably Woods Hole, MA; by Uzmann (1970) from southern New England waters; and by Montreuil (1954) from southern Nova Scotia or southeastern New Brunswick. Nickerson (1895) found the cysts only in the intestinal tract at the union of the intestine and rectum.

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RESILIENCE OF THE FISH ASSEMBLAGE IN NEW ENGLAND TIDEPOOLS[1]

Factors regulating density and species composition of tidepool fishes have been little studied, particularly in comparison to other elements of the intertidal community (Gibson 1982). Twenty-two collections of fishes were made in two tidepools at the Marine Science and Maritime Studies Center of Northeastern University at Nahant, MA, during summers from 1967 to 1985. Initially, the purpose was simply to demonstrate to my summer class in ichthyology the technique of collecting fishes with rotenone. After several years, it became apparent that there would be interest in examing long-term effects of repeated poisoning of the same pools. The purpose of this paper is to report the data from this series of samples and to compare the resilience of this New England tidepool fish fauna with studies done in the Gulf of California (Thomson and Lehner 1976), the central California coast (Grossman 1982), and South Africa (Beckley 1985). Unfortunately, there are no other similar tidepools in the area, so it was not possible to make control collections from unsampled pools.

Methods

The same two tidepools were sampled each summer from 1967 to 1985. The tidepools are located on the ocean side of East Point, in Broad Sound. The higher pool is at about 2 m elevation and is about 1 m deep at high tide; the lower pool is slightly below 1 m elevation, contains extensive red and brown algal growth, and is shallower. Average tidal amplitude is slightly over 3 m. One collection was made each year except for 1969, 1982, and 1983 when two collections were made, spaced about 2 wk apart. Collections

[1]Contribution No. 134 from the Marine Science Institute, Northeastern University, Nahant, MA 01908.

were made with rotenone (about 1 qt Noxfish[2]) at low tide in August, except in 1983 and 1985, when they were made in July and in 1984 when they were made in September. Specimens were taken by dip net from the pools by my students and me. An attempt was made to collect and then count and measure (mm SL) all fishes. Sometimes I used a face mask to find fishes at the bottom of the pool which was closer to the ocean. Many invertebrates also were killed, but no attempt was made to record numbers. The most abundant invertebrates in the 1984 collection were the green crab, *Carcinus maenas* (Linnaeus), and the sea urchin, *Strongylocentrotus droebachiensis* (Müller). Also collected were amphipods, *Gammarellus angulosus* (Rathke), *Calliopius laeviusculus* (Kröyer), and *Gammarus oceanicus* Segerstrale; isopods, *Idotea baltica* (Pallas); and scale worms, *Harmothoe imbricata* (Linnaeus).

Results

Thirteen species of fishes were collected (Table 1). The number of species per collection varied from 3 to 8 ($\bar{x}$ 5.3). One species, the rock gunnel, *Pholis gunnellus* (Linnaeus), was collected in all 22 samples. Young cunner, *Tautogolabrus adspersus* (Walbaum), were found in all but two collections. The grubby, *Myoxocephalus aenaeus* (Mitchill), and the threespine stickleback, *Gasterosteus aculeatus* Linnaeus, were present in 17 and 15 collections, respectively. The radiated shanny, *Ulvaria subbifurcata* (Storer), was taken 12 times. The seasnail, *Liparis atlanticus* (Jordan and Evermann), was taken in 10 collections, the mummichog, *Fundulus heteroclitus* Linnaeus, in 8. The American eel, *Anguilla rostrata* (LeSueur), was taken four times; young lumpfish, *Cyclpterus lumpus* Linnaeus, three times. Four of the 13 species were taken only once or twice: the Atlantic tomcod, *Microgadus tomcod* (Walbaum); Atlantic silverside, *Menidia menidia* (Linnaeus); ninespine stickleback, *Pungitius pungitius* (Linnaeus); and northern pipefish, *Syngnathus fuscus* Storer. I can detect no long-term change in species composition or number of individuals over the 19-yr period.

The number of specimens per sample varied from 17 to 1,850 ($\bar{x}$ 197.5), but the mean is distorted by the 1,842 young (9-28 mm SL) *Tautogolabrus adspersus* taken in sample 16. Deleting this number, the figures are 17-343 ($\bar{x}$ 119.2). Thus, a "typical" sample would consist of 41 *Pholis gunnellus*, 49 young *Tautogolabrus adspersus*, 12 *Myoxocephalus aenaeus*, 7 *Gasterosteus aculeatus*, and 2 *Fundulus heteroclitus*. One other species might be present, 1 or 2 specimens of any of the other 8 species, most likely *Ulvaria subbifurcata* or *Liparis atlanticus*.

There is great variation from collection to collection in numbers of specimens of the most abundant 4 species: 2-232 *Pholis gunnellus*; 2-1,842 *Tautogolabrus adspersus*; 1-127 *Myoxocephalus aenaeus*; and 1-44 *Gasterosteus aculeatus*. *Ulvaria subbifurcata*, *Liparus atlanticus*, *Cyclopterus lumpus*, and *Fundulus heteroclitus* showed much less variation, 1-12 per collection. The other 5 species were uncommon, numbering 1-4 specimens.

Discussion

To evaluate short-term effects, comparisons can be made between pairs of collections made in 1969, 1982, and 1983 at 2-3 wk intervals. The number of species decreased from 8 to 6 in the 1969 pair and from 7 to 5 in 1982, but the number increased from 3 to 5 in 1983. Four of the 8 species in the first sample in 1969, and 3 of the 7 species in the first sample in 1982, numbered only 1 or 2 specimens, as did one of the species in the second sample of 1983. Numbers of individuals were about the same in the 1969 pair of collections (over 50) and the 1983 pair (74 and 86), but decreased (54 to 17) in the second collection of the 1982 pair. Rapid recolonization of the tidepools clearly takes place. Differences in thoroughness of collecting, plus apparent random variation in the 7 least commonly taken species, can explain the few differences between the paired collections.

Thomson and Lehner (1976) sampled a large tidepool in the Gulf of California 11 times over the period 1966-73. The period of time between sampling ranged from 13 to 78 wk. Number of species ranged from 16 to 26, total 50; number of individuals 435-2,627, total 11,701. No decrease in number of species or individuals over time is apparent from their data (Thomson and Lehner 1970:table 1).

Grossman (1982) sampled a series of rocky tidepools with quinaldine at Dillon Beach in northern California 15 times from January 1979 to May 1981. The period of time between sampling ranged from 4 to 21 wk. Number of species per sample varied from 9 to 18 (excluding the first sample, 12-18), total 29 species; number of individuals was 71-517 per sample [not 520 as in Grossman's (1982) table 3], total 2,853 individuals. The structure of this rocky intertidal fish taxocene was persistent over 29 mo through 15 defaunations (Grossman 1982:table 3).

Beckley (1985) sampled three South African pools

[2]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

TABLE 1.—Abundance and size range (mm SL) of 13 species of fishes collected in two tidepools at Nahant, MA, from 1967 to 1985.

Species	1	2	3	4	5	6	7	8	9	10	11
Pholis gunnellus	11	2 (94-155)	21 (42-162)	20 (40-145)	36 (34-167)	67 (44-160)	33 (42-148)	6 (46-138)	8 (41-103)	8 (49-127)	13 (54-141)
Tautogolabrus adspersus	18	2 (77-96)	18 (10-17)	32 (18-30)		28 (11-20)	48 (9-28)	160 (10-27)	42 (12-28)	6 (11-26)	68 (10-32)
Myoxocephalus aenaeus	3 (70-105)	4 (61-81)	1 (78)	2 (34-75)	7 (52-67)	20 (53-102)	14 (36-92)	2 (69-91)			
Gasterosteus aculeatus		3 (34-52)	5 (47-59)		10 (21-59)	2 (54-62)	42 (12-34)	15 (14-60)	2 (28-59)	3 (49-57)	1 (27)
Ulvaria subbifurcata	2	1 (48)	1		2 (31-71)	1 (20)					
Liparis atlanticus	2		1			3	2 (23-28)				
Fundulus heteroclitus		11 (20-78)	6 (52-65)	"abdt."	4 (22-72)	7 (13-61)				6 (38-85)	
Anguilla rostrata				2 (60-80)				1 (89)			
Cyclopterus lumpus			1 (15)				3 (14-25)				
Microgadus tomcod				3							
Pungitius pungitius		2 (46-47)									
Menidia menidia											
Syngnathus fuscus							1 (111)				
No. spp.	5	7	8	6	5	7	7	5	3	4	3
No. spec.	36	25	54	51+	59	128	143	184	52	23	82
No. collectors	5	15	8	7	12	8	9	4	8	6	10
Field no.	1231	1250	1359	1367	1531	1534	1543	1563	1567	1648	1652
Date	8/16	8/29	8/7	8/21	8/6	8/17	8/22	8/17	8/15	8/14	8/19
Year	1967	1968	1969	1969	1970	1971	1972	1973	1974	1975	1976

TABLE 1.—*Continued.*

Species	12	13	14	15	16	17	18	19	20	21	22	No. of samples
Pholis gunnellus	12 (49-151)	50 (88-168)	183 (39-170)	57 (44-155)	2 (98-100)	25 (46-144)	10 (100-155)	52 (30-150)	32 (49-146)	13 (38-140)	232 (35-153)	22
Tautogolabrus adspersus	177 (9-65)	56 (11-29)	5 (26-42)	19 (9-24)	1,842 (9-28)	16 (9-23)	4 (11-13)	12 (9-10)	46 (9-18)	315 (10-31)		20
Myoxocephalus aenaeus		16 (29-81)	127 (26-72)	20 (17-73)		5 (54-72)	1 (92)	10 (46-71)	3 (66-75)	1 (41)	23 (50-78)	17
Gasterosteus aculeatus	1 (59)		13 (16-24)	44 (17-58)	6 (23-28)	3 (25-26)					1 (56)	15
Ulvaria subbifurcata	2 (35-59)	2 (21-79)	12 (20-87)	1 (84)		2 (27-32)	1 (80)				7 (20-96)	12
Liparis atlanticus			1 (32)			1 (36)	1 (38)		4 (22-27)	4 (25-28)	11 17-53)	10
Fundulus heteroclitus		2 (14-72)				2 (48-74)						8
Anguilla rostrata			1 (145)						1 (294)			4
Cyclopterus lumpus											9 (10-14)	3
Microgadus tomcod		1 (88)										2
Pungitius pungitius												1
Menidia menidia			1 (78)									1
Syngnathus fuscus												1
No. spp.	4	6	8	5	3	7	5	3	5	4	6	13 spp.
No. spec.	192	127	343	132	1,850	54	17	74	86	343	283	4,345 spec.
No. collectors	7	6	4	9	7	7	1	10	3	2	7	
Field no.	1657	1663	1752	1760	1769	1774	1775	1777	1780	1801	1802-3	
Date	8/20	8/15	8/16	8/9	8/15	8/17	8/31	7/9	7/27	9/4	7/6	
Year	1977	1978	1979	1980	1981	1982	1982	1983	1983	1984	1985	

with rotenone over a 2-yr period at intervals of 1 mo, 3 mo, and 6 mo. She found rapid recolonization but with lower densities of recolonizers in winter than in summer. During 26 monthly samples, only one of the original species did not recolonize the pool, while 13 additional species were found. In Pool 2, which was sampled in 3-mo intervals, 14 species were taken in the initial sample, 7-12 in subsequent samples. Three of the original 14 species failed to recolonize, but 8 additional species were taken. During four repeat visits to Pool 3, the number of species varied between 9 and 14, all but 1 species recolonized the pool, and 5 additional species were recorded.

My study and those of Thomson and Lehner (1976), Grossman (1982), and Beckley (1985) indicate great resilience of species of tidepool fishes in tropical and temperate waters. Recolonization is quite rapid, within a matter of weeks.

Acknowledgments

I thank the students and teaching assistants in my ichthyology course for helping to collect the material. James Dooley made the second 1982 collection. N. W. Riser of the Marine Science and Maritime Studies Center identified the invertebrates. Comments on drafts of this note were provided by G. D. Grossman, J. Randall, N. W. Riser, V. G. Springer, and A. B. Williams.

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PARASITES OF BENTHIC AMPHIPODS: CILIATES

Benthic gammaridean amphipods were sampled during a 2½-yr period as a part of the Northeast Monitoring Program (NEMP) of the Northeast Fisheries Center, National Marine Fisheries Service. The amphipod survey was designed to determine the kinds of parasites and pathological conditions occurring in amphipod populations that live in and on the sediments of the continental shelf from Maine to North Carolina. Microsporidans of the sampled amphipods have been discussed by Johnson (1985), and this paper presents and discusses data on host distribution, prevalence, effects on the host, and probable relationships, of ciliates parasitizing amphipods from the same samples.

Materials and Methods

Benthic amphipods were collected from 35 stations, mainly on the Georges Bank and Mid-Atlantic Bight (Fig. 1). Amphipods were sampled during 11 cruises, July 1980-November 1982 (Table 1). Each station was sampled from 1 to 10 times during the survey. The 11 stations indicated by solid circles on Figure 1 had the most consistent and numerous populations of amphipods, were sampled at least five times each, and yielded the majority of data presented here. A Smith-McIntyre grab and occasionally an epibenthic sled or scallop dredge were used to obtain the samples. Up to 30 individuals of each species present in a sample, and sometimes more depending on numbers present, were prepared for histological study. Details of collecting procedures and preparation of the amphipods for study are given by Johnson (1985).

Results

Host and geographic distribution of ciliate infection is given in Table 1. Ciliate-infected amphipods were taken in samples from at least one station on every cruise. There was no indication that prevalence was influenced by the season of the year or location of the positive stations. The majority of infected specimens were *Ampelisca agassizi* (Judd), but prevalence of ciliate infection was lower in *A. agassizi* than in the other species found infected (*Pontogeneia inermis* Krøyer, *Phoxocephalus holbolli* Krøyer, *Harpinia propinqua* Sars, and unidentified haustoriids) (Table 2). In three instances, at station 33, cruise G; station 48, cruise I; and station 57, cruise E, individuals of *H. propinqua* or *P. holbolli* were infected