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Biodiversity of Bear Seamount, New England Seamount Chain: Results of Exploratory Trawling

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Abstract

Bear Seamount (39°55'N 67°30'W) is an extinct undersea volcano located inside the U.S. Exclusive Economic Zone south of Georges Bank. The fauna associated with the seamount was little known until twenty trawl stations were made 2–7 December 2000, by the NOAA ship R/V *Delaware II*. The objective of the survey was to begin to document the biodiversity on and over the seamount, particularly of fishes, cephalopods, and crustaceans. Representatives of most species were preserved as vouchers and for subsequent definitive identification. This report presents a description of the biodiversity. A total of at least 274 species were collected. Preliminary identifications indicate the capture of 115 fish species. Among these were a number of new fish records for the area or rare species, including *Acromycter pertubator* (Congridae), *Diastobranchus capensis* (Synaphobranchidae), *Alepocephalus bairdii* (Alepocephalidae), *Mirognathus normani* (Alepocephalidae), *Bathygadus favosus* (Bathygadidae), *Nezumia longebarbata* (Macrouridae), *Gaidropsarus argentatus* (Phycidae), *Dibranchus tremendus* (Ogcocephalidae) and *Kali indica* (Chiasmodontidae). Only two fish species of potential commercial importance were encountered: *Coryphaenoides rupestris* and *Macrourus berglax.* Cephalopods comprised 26 species from 15 families, including one new distributional record and several rarely-collected species. The crustacean fauna was diverse with at least 46 species. Totals for other invertebrate species are pending laboratory identification, but number at least 87 species from 10 Phyla. This includes a number of new distributional records and a new species of gorgonian.

Key words: biodiversity, deep-sea, fauna, fishes, invertebrates, North Atlantic, seamount

Introduction

Seamounts represent biological islands in the deep sea and often feature characteristic faunas that are quite different from those found in the surrounding soft sediment and abyssal habitats. Large depth ranges, hard substrates, steep gradients, complex topography, impinging currents, topographically induced upwellings, clear oceanic water, and geographic isolation all combine to make seamounts specialized habitats for deep-sea organisms (Rogers, 1994). The benthic fauna on seamounts include species that create structural habitat diversity and likely create essential habitats for some deep-sea fishes and crustaceans.

The New England Seamounts (NES) make up the longest seamount chain in the North Atlantic, encompassing more than 30 major volcanic peaks extending southeast from Georges Bank for about 1 200 km to the eastern end of the Bermuda Rise, ending abruptly with Nashville Seamount to the East North East of Bermuda (Fig. 1). The major peaks of the NES rise as much as 4 000 m above the Sohm Abyssal Plain.

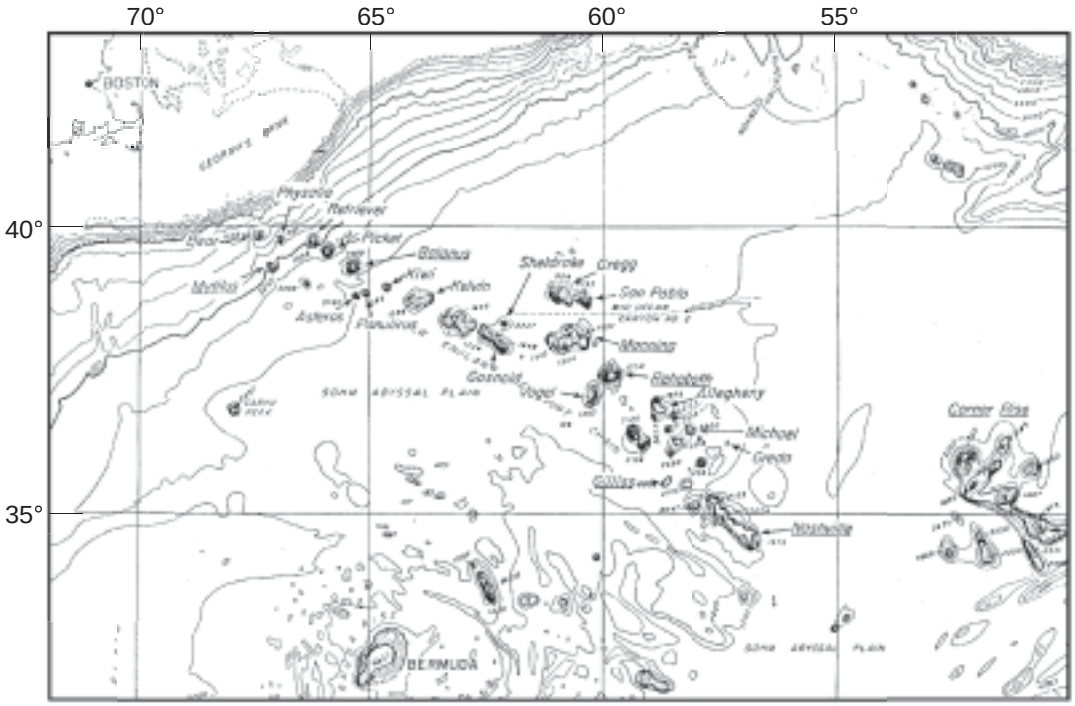

Fig. 1. Bathymetric chart of the New England Seamount chain showing depth contours (m) (from Houghton *et al*., 1977).

About 300 km east of Nashville Seamount, the Corner Rise Seamounts form a cluster of peaks midway between the eastern end of the NES and the Mid Atlantic Ridge. The NES and Corner Rise Seamounts resulted from a mantle-plume hotspot, which moved towards the Mid Atlantic Ridge and currently resides underneath Great Meteor Seamount (Sleep, 1990).

The NES chain lies roughly perpendicular to two major currents, the Gulf Stream, flowing to the northeast, and the Deep Western Boundary Current, which flows southwesterly along the continental slope (Hamilton *et al*., 1996). In addition, the Antarctic Bottom Water flows around the bases of the seamounts at the eastern end of the chain. These seamounts alter the flow of the currents in their vicinity (Vastano and Warren, 1976; Hogg *et al*., 1986), which may influence the recruitment of benthic and pelagic organisms.

While the geology of the NES and the effects of the seamounts on the Gulf Stream have been extensively studied, the biota has been almost completely ignored (Zeigler, MS 1955; Uchupi *et al*., 1970; Vastano and Warren, 1976; Houghton *et al*., 1977; Heirtzler *et al*., MS 1977 and 1977; Hogg *et al*., 1986). A review of the biogeography of seamount fauna around the world (Wilson and Kaufman, 1987) makes note of only one species known from the entire NES chain (the stony coral *Enallopsammia rostrata* from Gregg Seamount). Because of this dearth of biotic information, the NES was excluded from a recent discussion on the biology of seamounts around the world (Rogers, 1994).

Examinations by one of us (JAM) of archived photos taken during the geological investigation of the NES has found that more than 50 species of invertebrates and at least eight species of fishes do in fact live on these seamounts. Exploratory commercial fishing in 1997 on Bear Seamount (the closest NES to the U.S.) captured another seven fish species, including two species previously known from the eastern Atlantic (*Hydrolagus pallidus* and *Bathypterois dubius*) and one previously found only in the temperate southern hemisphere (*Diastobranchus capensis*; Moore *et al*., 2003). Clearly, much can be done to investigate the NES fauna and integrate that information into the extensive knowledge gained from other seamounts in the Atlantic, Pacific, and elsewhere in the world.

With the increase of deep-sea fisheries, interest in commercially fishing seamounts has increased (Koslow, 1997). Yet seamounts hold concentrations of sessile suspension-feeding invertebrates, such as scleractinians, gorgonians and sponges, that add structural complexity, and there are concerns about the impact of fishing activities on these invertebrates (Dayton *et al*., 1995; Auster *et al*., 1996; Probert *et al*., 1997; Koslow and Gowlett-Holmes, MS 1998; Moore and Mace, 1999; Koslow *et al*., 2000). A recent haul of Darwin's roughy (*Gephyroberyx darwini,* also known as big roughy) from a canyon on the south side of Georges Bank generated renewed interest by some U.S. fishers in exploring the deepwater fishery resources of New England. One fishing company put forward a specific proposal to explore the fishery resources on Bear Seamount. This coincided with planning by the National Marine Fisheries Service (NMFS) to conduct an exploratory survey to Bear Seamount in late-2000. One objective of this survey was to begin to document the biodiversity on and over the seamount, particularly of fishes, cephalopods, and crustaceans before large-scale commercial fishing begins. Knowledge of the fauna associated with the seamounts is considered crucial in assessing the impacts of any subsequent commercial fishing on these seamounts and a lack of this kind of information has hindered assessments of fishing impacts in other areas (Koslow and Gowlett-Holmes, MS 1998).

Bear Seamount (39°55'N 67°30'W) is an extinct undersea volcano located inside the U.S. Exclusive Economic Zone south of Lydonia Canyon on Georges Bank. Bear Seamount rises from the continental slope at depths of 2 000–3 000 m to a generally flat summit at a depth of 1 100 m below the sea surface. Although the upper surface of Bear Seamount is draped in many places with thick sediment, there are also outcrops of basaltic volcanic rock and scattered glacial erratics varying in size from small pebbles to large boulders. These glacial erratics most likely fell to the seamount after dropping from icebergs calving off the glaciers that extended to Georges Bank during the Pleistocene.

Bear Seamount was first identified, named and sonar mapped during a series of surveys by Woods Hole Oceanographic Institution (WHOI) vessels in 1954 (Zeigler, MS 1955). Subsequent investigations of Bear Seamount include more sonar mapping, one chain-bag dredge haul and one camera lowering in 1962 (R/V *Atlantis* cruise A-281; Pratt and Thompson, MS 1962), two *Alvin* dives in 1968 (*Alvin* dive 286 and 287), and a commercial exploratory trawl by the F/V *Matthew Melissa* out of Stonington, Connecticut, in 1997. A list of taxa identified from these previous studies is given in Table 1.

Prior to our first cruise in 2000, several invertebrates and a few fishes were identified from archived photos from *Atlantis* cruise A-281 and *Alvin* dives 286 and 287. The archived photos are available at the Document Library of Woods Hole Oceanographic Institution. In addition, several fish specimens were acquired from a commercial trawler that conducted a few deepwater exploratory tows on the top of Bear Seamount in 1997. These specimens are deposited at the Ichthyology Collection of the Peabody Museum of Natural History, Yale University.

Materials and Methods

Twenty hauls were made on or over Bear Seamount using double-warp gear towed from the NOAA vessel R/V *Delaware II* from 2–7 December 2000 (cruise DE00-11). Of these hauls, 11 were fully pelagic tows and 9 actually touched bottom, if only briefly in some instances. Each tow was for one hour once the net was set at the selected depth, however, bottom tows were not necessarily in contact with the bottom that entire time. Tow depths were between 900–2 500 m. Six hauls were made with an IYGPT midwater trawl, five hauls with a NMFS standard shrimp trawl, and nine tows with a Yankee 36 otter trawl. The differing biases and catchabilities of these three kinds of nets, plus the unknown amount of time spent trawling the bottom, make explicit calculations of diversity indices suspect. Catches were sorted and given preliminary identifications on shipboard. Tissue samples of many fish and cephalopod taxa were taken for DNA analysis (samples of fishes are deposited at the Museum of Natural History, University of Kansas). Representatives of most species were preserved as vouchers. The voucher specimens are deposited in the Museum of Comparative Zoology at Harvard University (most of the fish specimens), Peabody Museum of Natural History at Yale University (some invertebrates), and the National Museum of Natural History, Smithsonian Institution (some fishes and most of the invertebrates). Many specimens were sent to taxonomic experts for subsequent definitive identification. A list of those experts is given in the acknowledgments.

TABLE 1. Taxa seen or sampled from Bear Seamount prior to 2000.

PROTISTA
Globose syringaminid? xenophyophore
PORIFERA
Unidentified sponges (>5 spp.)
CNIDARIA
Cerianthid anemone
Unidentified large light-colored anemone
Desmophyllum cristagalli scleractinian coral
Lepidisis sp.unbranched spiral whip coral
Primnoa sp. gorgonian coral
Pinnate antipatherian corals
Anthophilum sp. sea pen
SIPUNCULIDA
Unidentified sipunculid worm
ANNELIDA
Hyalinoecia sp. polychaete worm
ARTHROPODA
Neolithodes sp. stone crab
Unidentified spider crab assoc. w/ urchin
ECHINODERMATA
Solaster sp. sunstar
Porania sp. sea star
Neomorphaster sp. small 5-arm sea star
Ophiomusium lymani brittle star
Unidentified light brittle stars
Echinus affinis urchin
Echinothuriid pancake urchin
Unidentified 5-arm bathycrinid crinoid
Peniagone sp. sea cucumber
UROCHORDATA
Large transparent unstalked tunicate
PISCES
Hydrolagus pallidus chimaera*
Apristurus sp. deepwater catshark*
Bathyraja sp. skate
Unidentified notacanthid spiny eel
Unidentified halosaur
Serrivomer beanii sawpalate eel*
Diastobranchus capensis cuthroat eel*
Unidentified cutthroat eel
Unidentified alepocephalid smoothhead
Bathypterois dubius spiderfish*
Coryphaenoides sp. grenadier
Unidentified morid codling
Anoplogaster cornuta fangtooth*
Antigonia capros deepbody boarfish*
Sebastes sp. redfish
Zoarces atlanticus eel-pout

* identified by J. A. Moore, from commercial trawl 1997.

Results

Table 2 provides a list of the species collected during cruise DE00-11 and identified to date. We report a total of at least 274 species collected on or over Bear Seamount (Table 1 contains an additional 12 species not in Table 2 to give a total of at least 286 species known from Bear Seamount). The numbers of individuals for each species were recorded to give a qualitative sense of the relative abundances. For some very abundant animals (e.g. euphausids, *Cyclothone*, *Sergestes* and *Pasiphaea*), only a small number of representative specimens were counted and kept, while for some fragmentary animals (e.g. hexactinellid sponges, *Lophelia pertusa* and *Lepidisis*) not all individuals were determinable. In addition, some animals were badly damaged by the trawl nets and difficult to identify (e.g. Myctophidae indet. and *Cyclothone* sp. indet.).

Preliminary identifications indicate that 115 fish species were captured (Table 2). Several new fish records for the area or rare species were collected (Moore *et al*., 2003, including *Acromycter pertubator* (Congridae), *Diastobranchus capensis* (Synaphobranchidae), *Alepocephalus bairdii* (Alepocephalidae), *Mirognathus normani* (Alepocephalidae), *Bathygadus favosus* (Bathygadidae), *Nezumia longe-barbata* (Macrouridae), *Gaidropsarus argentatus* (Phycidae), *Dibranchus tremendus* (Ogcocephalidae), and *Kali indica* (Chiasmodontidae). The cephalopods comprised 26 species from 15 families, including one new

TABLE 2. Taxa collected on or over Bear Seamount during NMFS cruise DE00-11 from 2–7 Dec 2000.

PROTISTA	
Agglutinated foraminiferans (3+ spp.)[1]	>20[2]
PORIFERA	
Boring sponge (in gorgonian base)	1
Demospongae fragments	>6
Small stoloniferous sponge	>4
Geodia sp.	1
Hexactinellid fragments	>6
CNIDARIA	
Scyphozoans (8+ spp.)	>89
Poralia rufescens	1
Siphonophore pieces	>8
Marrus orthocanna	1
Knobby pink anemone	2
Small white anemone	3
Amphianthus or *Stephanauge* sp.	2
Thecate hydroid attached to *Lophelia*	1
Epizoanthus paguriphilus	46
Caryophyllia ambrosia	10
Flabellum alabastrum	7
Vaughanella margaretata	1
Lophelia pertusa	5
Acanthogorgia angustiflora	2
Paragorgia sp.	5
Swiftia? sp.	1
Lepidisis sp.	>5
Anthoptilum grandiflorum	9
Funiculina sp.	1
Anthomastis agassizii	4
CHAETOGNATHA	
Chaetognaths	>3
NEMERTEANS	
Nectonemertes mirabilis	2
Dinonemertes cf. *investigatoris*	1
ANNELIDA	
Polychaete burrowing in wood	3
Polychaete in tubes within *Lophelia*	2
ANNELIDA (Continued)	
Serpulid with large triangular tubes	>4
Serpulid with small round tubes	>40
MOLLUSCA	
Nudibranch	1
Calliotropis bairdii	5
Pleurotomella sp.	1
Gastropod sp. 1	1
Gastropod sp. 2	1
Gastropod sp. 3	11
Bivalve sp. 1	1
Heteropods	>10
Pteropods	>20
Clione sp.	1
CEPHALOPODS	
Lampadioteuthis megaleia	1
Abralia veranyi	1
Abraliopsis hoylei	5
Pyroteuthis margaritifera	1
Pterygioteuthis gemmata	1
Pterygioteuthis giardi	1
Taningia danae	1
Octopoteuthis megaptera	1
Gonatus fabricii	2
Histioteuthis sp.	4
Histioteuthis dofleini	1
Histioteuthis reversa	2
Bathyteuthis abyssicola	1
Brachioteuthis sp.	1
Illex illecebrosus	2
Chiroteuthis sp.	2
Chiroteuthis spoeli	1
Chiroteuthis veranii	2
Mastigoteuthis sp.	5
Mastigoteuthis agassizi	8
Mastigoteuthis magna	25
Cranchiidae indet.	1
Taonius pavo	2
Teuthowenia megalops	5
Stauroteuthis syrtensis	2
Eledonella pygmaea	1
Macrotritopus defilippi	2
Graneledone verrucosa verrucosa	2
Vampyroteuthis infernalis	2

[1] In a few instances, taxonomic experts indicated the number of species they could distinguish, without necessarily giving the explicit species names and these numbers of species are indicated below in parentheses following the taxonomic group name.

[2] For some very abundant animals (euphausids, *Cyclothone*, and *Pasiphaea*), only a small number of representative specimens were counted and kept, and for some or fragmentary animals (e.g. *Ophiomusium lymani* and *Lepidisis*) not all individuals were determinable. These are noted with a > sign before the actual number counted.

TABLE 2. (Continued). Taxa collected on or over Bear Seamount during NMFS cruise DE00-11 from 2–7 Dec 2000.

ARTHROPODA	
Syscenus atlanticus	27
Bopyrid isopod (in *Glyphocrangon*)	1
Hyperiid amphipods indet.	>49
Hyperia galba	2
Phronima sp.	2
Unidentified large red amphipod 1	
Colossendeis colossea	22
Scalpellum sp. 1	
Plesiopeneaus edwardsianus	10
Acanthephyra sp. (4 spp.)	>78
Glyphocrangon sculpta	>10
Notostomus sp.	4
Pasiphaea sp. (3 spp.)	>51
Gennadas sp. (3–4 spp.)	>41
Sergestes sp. (10 spp.)	>130
Homolids	2
Oplophorus sp.	1
Systellaspis sp.	2
Euphausids	>53
Pandalus carinatus	1
Stylopandalas sp.	7
Polycheles granulatus	12
Steromastis nana	6
Polychelid spiny form	2
Munidopsis sp.	8
Galathaea rostrata	1
Munidopsis curvirostra	1
Mysids	>69
Gnathophausia zoea	>24
Parapagurus pilosimanus	46
Neolithodes grimaldii	1
Copepod parasite on *Synbranchus* eel	1

ECHINODERMATA	
Crinoid fragments	2
Elasipodid holothurian	6
Psychropotes depressa	1
Plutonaster agassizi	6
Psilaster andromeda florae	1
Cheiraster sepitus	6
Persephonaster sp.	2
Ceramaster granularis	1
Mediaster bairdi	15
Pseudarchaster parelii	2
Neomorphaster forcipatus	95
Chondraster grandis	3
Henricia sp.	1
Pteraster sp.	1
Solaster benedicti	1
Zoroaster sp.	1
Brisingia costata	1
Freyella microspina	2
Freyella elegans	1
Asteroschema sp.	2

ECHINODERMATA (Continued)	
Ophiomusim lymani	>141
Ophiacanthidae sp.	1
Ophiacantha sp.	4
Amphiophiura saurura	8
Homophiura tessellata	9
Ophiocten gracilis	7
Ophiura ljungmani	36
Simple-armed basket star	1
Echinus affinis	159
Echinus sp.	3
Zygothuria lactea	4
Phorosoma placenta	20
Hygrosoma petersi	9

UROCHORDATA	
Stalked tunicates	9
Thaliacean salps	>9
Pyrosoma sp.	>3

PISCES	
Hydrolagus affinis	4
Apristurus manis	14
Apristurus profundorum	5
Etmopterus princeps	2
Raja bigelowi	2
Aldrovandia sp. indet.	13
Aldrovandia affinis	48
Aldrovandia oleosa	1
Aldrovandia phalacra	171
Halosauropsis macrochir	4
Notacanthus chemnitzi	4
Polyacanthonotus challengeri	1
Polyacanthonotus rissoanus	3
Ilyophis brunneus	2
Diastobranchus capensis	1
Synaphobranchus sp.	17
Synaphobranchus kaupii	90
Derichthys serpentinus	1
Nessorhamphus ingolfianus	2
Nemichthys scolopaceus	10
Congridae larvae	7
Acromycter perturbator	1
Ariosoma sp. Larvae	16
Venefica procera	2
Serrivomer beanii	27
Eurypharynx pelacanoides	11
Bathylagus berycoides	1
Bathylagus euryops	12
Dolichopteryx sp.	2
Alepocephalus agassizi	8
Alepocephalus australis	13
Alepocephalus bairdii	1

TABLE 2. (Continued). Taxa collected on or over Bear Seamount during NMFS cruise DE00-11 from 2–7 Dec 2000.

PISCES (continued)	
Alepocephalus cf. *umbriceps*	1
Bajacalifornia megalops	1
Mirognathus normani	1
Narcetes stomias	1
Rouleina attrita	1
Maulisia sp.	2
Cyclothone sp. indet.	332
Cyclothone pallida	1
Cyclothone microdon	>308
Gonostoma bathyphilum	32
Gonostoma elongatum	58
Chauliodus sloani	34
Argyropelecus aculeatus	16
Argyropelecus hemigymnus	4
Sternoptyx diaphana	18
Sternoptyx pseudobscura	1
Valenciennellus tripunctulatus	1
Vinciguerria nimbaria	1
Malacosteus niger	7
Aristostomias tittmani	1
Bathophilus pawneei	1
Borostomias antarcticus	1
Leptostomias longibarba	1
Melanostomias bartonbeani	2
Photostomias guerneri	4
Stomias boa ferox	20
Stomias affinis	1
Bathypterois phenax	28
Bathypterois quadrifilis	16
Scopelosaurus lepidus	1
Bathysaurus ferox	3
Arctozenus rissoi	1
Paralepis sp.	2
Paralepis coregonoides	1
Myctophidae indet.	97
Benthosema glaciale	73
Ceratoscopelus maderensis	18
Ceratoscopelus warmingii	5
Diaphus brachycephalus	1
Diaphus dumerili	9
Diaphus rafinesquii	4
Hygophum taaningi	1
Lampadena speculigera	1
Lampanyctus photonotus	4
Lobianchia dofleini	30

PISCES (continued)	
Lobianchia gemellari	2
Myctophum affine	3
Nannobrachium atrum	1
Nannobrachium lineatum	7
Nannobrachium mcdonaldi	3
Nannobrachium lineatum	7
Nannobrachium mcdonaldi	3
Notoscopelus resplendens	2
Symbolophorus veranyi	1
Dicrolene intronigra	2
Penopus microcephalus	1
Porogadus miles	4
Bassogigas gilli	1
Bathygadus favosus	5
Coryphaenoides alateralis	2
Coryphaenoides carapinus	36
Coryphaenoides rupestris	89
Macrourus berglax	25
Nezumia longebarbata	5
Nezumia sclerorhynchus	1
Nezumia suilla	2
Sphagemacrurus grenadae	4
Trachonurus sulcatus	2
Antimora rostrata	20
Gaidropsarus ensis	2
Gaidropsarus argenteus	1
Halargyreus johnsoni	15
Dibranchus tremendus	1
Cryptopsaras couesii	2
Melamphaes microps	1
Melamphaes suborbitalis	4
Poromitra megalops	3
Scopelogadus beanie	23
Scopeloberyx opisthopterus	33
Anoplogaster cornuta	1
Cottunculus thomsoni	1
Howella brodei	1
Anthias nicholsi larva	1
Platyberyx opalescens	1
Lycodes atlanticus	6
Melanostigma atlanticum	1
Chiasmodon niger	4
Kali indica	1
Glyptocephalus cynoglossus larvae	3
Poecilopsetta beani larva	1

distributional record (i.e. *Chiroteuthis spoeli*) and several rarely-collected species. The crustacean species numbered at least 46 species and again included unusual species. For example, a redescription of a rare isopod species (*Syscenus atlanticus*, previously known only from off Iceland) has been submitted for publication based in part on specimens from Bear Seamount (Kensley, 2003). Totals for other invertebrate species are pending laboratory identification, but number at least 87 species in 10 Phyla. Notable captures of other invertebrates include a solitary coral, *Vaughanella margaretata*, which represents the first record of this

species since its original description over one hundred years ago (S. Cairns, National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA, pers. comm.). We have also been informed of a number of new distributional records and an undescribed species of gorgonian (F. Bayer, National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA, pers. comm.)

Only two fish species of potential commercial importance were encountered: *Coryphaenoides rupestris* and *Macrourus berglax. Coryphaenoides rupestris*, the roundnose grenadier, was caught at 4 stations at depths of 1 100–1 800 m. They ranged from 47–103 cm total length, with an average length of 85 cm total length. A total of 89 individuals were caught, with the highest catch of 46 individuals at one station, weighing a total of 65.1 kg. *Macrourus berglax*, the roughhead grenadier, was captured at 5 stations, also at depths of 1 100–1 800 m. They ranged from 31–104 cm total length, with an average length of 50 cm. Twenty-five individuals were caught, with a highest single catch of 10 individuals.

The only commercially exploited cephalopod captured, *Illex illecebrosus*, consisted of just two individuals. Only a few exploited or potentially exploitable crustaceans were taken from Bear Seamount (a few isolated individuals of scarlet shrimp, *Plesiopeneaus edwardsianus,* several glass shrimps, *Pasiphaea* spp., and the porcupine stone crab, *Neolithodes grimaldii*; Pohle *et al*., 1992*)*.

Discussion

Our results have some bearing on statements made by Wilson and Kaufman (1987) in their review of seamount biota. For instance, they state that although ophiuroid brittlestars are widespread and common in deep-sea sedimentary environments, they have been reported from very few seamounts. Our survey collected a number of ophiuroid species and found the brittlestar *Ophiomusium lymani* to be common in all the benthic trawls. Archived photos of other seamounts in the NES chain also show numerous brittlestars on soft sediment, on rocks, and perched in the fronds of gorgonians (see Fig 9 in Houghton *et al*., 1977).

Wilson and Kaufman (1987) also state that few of the reported seamount crustaceans are truly benthic. However, we collected a number of benthic crustacean species from Bear Seamount. A large spider crab, *Neolithodes grimaldii*, and numerous hermit crabs, *Parapagurus pilosimanus*, were taken, as were a variety of polychelid and galatheid crustaceans. Also, a gooseneck barnacle (*Scalpellum* sp.) was collected attached to a small glacial pebble. Archived photos from the two *Alvin* dives on Bear Seamount show a *Neolithodes* in a shallow dish-like depression, an unidentified small spider crab associated with an urchin, and large red shrimp, possibly *Plesiopenaeus edwarsianus*, just inside the mouths of small burrows in the soft sediment.

With regards to seamount fish fauna, Wilson and Kaufman (1987) state that fishes are associated with seamounts elsewhere, but have not been reported from the western North Atlantic seamounts. This was true at the time of that paper. Since then, Vinnichenko (1997) published a list of the fishes found on the Corner Rise Seamounts (about 300 km east to the eastern end of the NES). That faunal list compares well with our list of fishes from Bear Seamount. The main difference is that the Corner Rise features many species more typically found in the deep waters of the eastern North Atlantic, while our list has many more western North Atlantic deepwater species. However, a few eastern Atlantic species (e.g. *Hydrolagus pallida* and *Bathypterois dubius*) were found on Bear Seamount and may indicate that the NES chain provides a westward route of dispersal for at least some eastern Atlantic species.

Large pieces of live *Lophelia pertusa* were collected from two of the bottom hauls indicating that deepwater coral banks may exist on this seamount. Evidence of *Lophelia* sp. has also been noted from other areas of NES (Pratt and Thomson, MS 1962; Heirtzler *et al*., MS 1977). This species has been associated with very diverse communities elsewhere in the North Atlantic (Jensen and Frederiksen, 1992; Mortensen *et al*., 1995; Rogers, 1999). Similarly diverse communities may also be present on Bear Seamount. We can note the following invertebrates found in direct association with the *L. petusa* trawled from Bear Seamount: a large polychaete worm living in tubular spaces within the coral colony, attached solitary coral, *Caryophila ambrosia*, small serpulid worm tubes, a thecate hydroid, and the octocoral *Swiftia*.

Even though Bear Seamount rises up out of the continental slope of Georges Bank, it apparently provides sufficiently unusual habitats or conditions that allow various species not generally reported from the nearby slope to live on the seamount. Three of us have

worked on a checklist of deepwater fish species for all of New England (Moore *et al*., 2003). The trawls on Bear Seamount resulted in six new additions to that checklist. Our regional list of deep-sea fishes recorded about 591 species in the vicinity of Georges Bank, from the slope to the abyssal plain, whereas we report 115 fish species from Bear Seamount. It is clear that this investigation of Bear Seamount is quite preliminary and that many more species of fishes and invertebrates will likely be found associated with the seamount. Because of the more unusual habitats on the seamount, it is also quite possible that more new additions to the region will also be found on the seamount.

Similarly, the cephalopods from this survey add to the slope fauna recently compiled by Vecchione (2000) and Vecchione and Pohle (2002). Photographs of some of these unusual cephalopods have been added to the cephalopod section of the Tree of Life project on the World Wide Web at:

http://tolweb.org/tree/eukaryotes/_animals/mollusca/cephalopoda/cephalopoda.html

The numerous novel records of species associated with the seamount in our study could indicate that there is some degree of separation of the seamount fauna from the nearby continental slope, or our ignorance of what lives in the deep sea may still be so great that a single survey can add much new information, despite many deepwater investigations in the region over the last 130 years.

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