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AT THE NEW ENGLAND FISHERY MANAGEMENT COUNCIL MEETING

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January 28, 2015

E.F. "Terry" Stockwell III, Chairman
New England Fishery Management Council
50 Water Street, Mill 2
Newburyport, MA 01950

Re: Omnibus Habitat Amendment

Dear Chairman Stockwell:

As you know, we represent the Fisheries Survival Fund ("FSF"). FSF's participants include over 250 full-time Atlantic scallop limited access permit holders. These are all actively working fishing vessels. FSF respectfully submits these comments in response to the letter sent by John Bullard, Regional Administrator of the National Marine Fisheries Service ("NMFS"), to the New England Fishery Management Council ("Council") on January 8, 2015, regarding the Council's selection of alternatives in its Omnibus Essential Fish Habitat ("EFH") Amendment 2 Draft Environmental Impact Statement ("DEIS").

FSF has serious concerns about several statements in this letter. While we appreciate the agency's recognition of the need to select practicable management actions, its position on specific alternatives in the Great South Channel and on Georges Bank are based on erroneous information. For eight years since it voted on the EFH aspects of the DEIS, the Council has continued to develop analyses and, ultimately, a range of alternatives based on the best available scientific information. That information must be considered as you select alternatives in this action, as it has refined and improved the analysis on which the Volume I of the EFH DEIS, including its proposed habitat area of particular concern ("HAPC") designations, was based in 2007.

We are also concerned that the agency has mischaracterized certain physical aspects of the two regions, continued to propagate a nonexistent linkage between broad scale year-round closures and groundfish productivity, and failed to consider the impacts of selected alternatives on the Georges Bank juvenile cod stock as a whole. Furthermore, the agency has overstated the legal and management obligations associated with EFH and HAPC designations. FSF supports the use of best scientific information available and urges the Council to follow the regulations and its own goals, and to base its decisions in the context of the entire record.

I. HAPCs MUST BE DESIGNATED AND MANAGED USING RIGOROUS AND CONTEMPORARY ANALYSIS AND INFORMATION

The concept of HAPCs was implemented through regulation by NMFS's Final Rule on Essential Fish Habitat.[1] The rule allows a Council to designate HAPCs as subsets of EFH that are particularly vulnerable to fishing activities. As NMFS recognized in its January 8, 2015, letter, HAPCs do not impose any regulatory requirements, but rather highlight areas for additional analysis and require and in-depth review of the effects of fishing in these areas.[2] NMFS cannot reasonably claim HAPCs designated in 2007 based on qualitative information must be treated as sacrosanct in 2015. The Council has undertaken another eight years of analyses that must be used to inform contemporary management decisions regarding fishing in these areas.

A. HAPCs Are Simply Tools for Highlighting Important Management Areas

If a Council does choose to designate an HAPC, then, how it manages fishing activities within the HAPC is up to its reasoned discretion, based on the best available scientific information. At the time the EFH final rule was implemented, members of the public questioned NMFS' authority to create a subset of EFH that NMFS opted to term "HAPC". In response, the agency stated that "NMFS cannot require Councils to designate HAPCs. Any higher degree of protection for areas designated as HAPCs would result from having more available information about the function or sensitivity of the habitat, or the human-induced threats to the habitat, which may justify more stringent or precautionary management approaches."[3]

The Council's designation of HAPCs in 2007 occurred during the first phase of the development of the DEIS. That designation, together with the options currently under consideration in Volume III of the DEIS, constitute one Council action that will be implemented through the typical public notice and comment period once final action is taken on Volume III.

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[1] 67 Fed. Reg. 2343 (January 17, 2002).

[2] "Each FMP must contain an evaluation of the potential adverse effects of fishing on EFH designated under the FMP... The evaluation should give special attention to adverse effects on habitat areas of particular concern." 50 C.F.R. 600.815(a)(2)(i).

[3] 67 Fed. Reg. at 2357.

That means that no final decision has been made on the entire document, and the analytical process is still ongoing. Indeed, the Habitat Plan Development Team and Committee reviewed the HAPCs once already in the fall of 2010 and spring of 2011, and suggested some modifications to the alternatives that were approved in 2007.

B. The 2007 HAPC Designations Are Not Based on the Best Scientific Information Available

The fact that the HAPCs were developed eight years ago, have only been partially reviewed, and have not been formally implemented, raises consideration of the National Standard 2 mandate that management decisions be based on the best available scientific information. The regulations promulgating the EFH final rule also explicitly require the use of the best available scientific information in designating EFH.[4] Therefore, the Council may either choose to manage using its 2007 HAPC designations in light of the rigorous analysis that has occurred over nearly a decade thereafter, or it may revisit the designations using information developed during Volume III's preparation. Relying too heavily on HAPCs that were delineated in 2007 based primarily on qualitative information, when peer-reviewed scientific information is now available, is inconsistent with the record and thus arbitrary and capricious.[5]

In light of the entire record constructed during the development of the Omnibus EFH Amendment 2, it is unclear how the agency can support its statement that the Council has not recognized the importance of the HAPCs designated in 2007. The habitat amendment process has been thorough, rigorous, and has evaluated the impacts of management alternatives in areas including the proposed HAPC using the best available science. Indeed, the Council has precisely recognized the importance of HAPCs, as well as all vulnerable habitat types, and considered ways to reduce impacts to those habitats to the letter of the law throughout this long process.

More specifically, the HAPCs were designated prior to the development of a whole series of rigorous analytical tools that were used in drafting the Alternatives in Volume III of the DEIS. These include:

1. The peer-reviewed Swept Area Seabed Impact ("SASI") model;
2. The Local Indicators of Spatial Association ("LISA") cluster analysis;
3. The Closed Area Technical Team's ("CATT's") "hotspot analysis";
4. Characterization of the substrate and ocean energy dynamics; and

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[4] "Councils should obtain information to describe and identify EFH from the best available sources, including peer-reviewed literature, unpublished scientific reports, data files of government resource agencies, fisheries landing reports, and other sources of information." 50 C.F.R. 600.815(a)(1)(ii)(B).

[5] *See, e.g., Motor Vehicle Manufacturers Ass'n v. State Farm*, 463 U.S. 29 (1983).

5. The practicability analysis.

These tools, and indeed the deliberations of the Council, its committees, and numerous government, academic, and independent scientists and peer review panels, have comprised a sophisticated analysis in how to apply the EFH regulations and, by inclusion, the HAPC provisions. The SASI model, in particular, has been the subject of multiple peer reviews, not only by the Council's own committees, including its Scientific and Statistical Committee, but by external reviewers as well. In each review, it emerged as the best possible tool for analyzing habitat impacts in New England. Therefore, management decisions must be based upon the synthesis of information generated by these five tools—not solely based upon sorely outdated HAPC designations.

II. ANALYTICAL BASIS FOR AMENDMENT ALTERNATIVES

A. Great South Channel

1. The Record Supports More Refined Ways of Meeting the Goals of the HAPC Designation

The agency's letter focuses on Alternative 3 as a starting point, but then goes on to direct that "[m]odifying Alternative 3 by shifting the boundaries to focus more closely on the less dynamic and more vulnerable cobble and boulder areas would create a more effective habitat management area." Notably, that is exactly why Alternatives 4 and 5 do—focus habitat protections inshore of high energy Channel areas.

There is no record-based reason, moreover, why the agency needs to work from Alternative 3, which has the highest adverse economic impacts of all the alternatives by far. For starters, each of the alternatives in the DEIS (with the exception of the no action alternative) overlap portions, but not the entirety, of the HAPC. The entire rationale for designating the Great South Channel HAPC provided in Volume II of the DEIS is "to recognize the importance of the area for its high benthic productivity and hard bottom habitats, which provide structured benthic habitat and food resources for cod and other demersal-managed species." This goal is achieved through the DEIS alternatives that have been refined based on analysis subsequent to the HAPC designation.

2. *Alternatives 3, 4, and 5 Have Comparable Habitat Impacts Under DEIS Analysis*

The economically crippling Alternative 3 scores no better on habitat sensitivity than more reasoned alternatives. More specifically, the LISA cluster analysis outputs, based on the SASI model, identified groups of areas that were more vulnerable to the adverse effects of fishing with bottom trawls and scallop dredges. In the Channel, Alternatives 3-6 have nearly identical maximum vulnerability scores ranging from 65.5 to 66.1 for scallop dredge and 63.2 to 63.6 for otter trawl. All of those alternatives, including Alternatives 4 and 5, were also developed to cover LISA spots beyond the HAPC, creating an improvement over the HAPC and over "no action." Although the number of groundfish hotspots varies in the different alternatives, the only ones that the CATT identified for cod in the Great South Channel are in the no action alternative.[6]

3. *Alternatives 3, 4, and 5 Are All High Energy*

Nearly the entire Great South Channel is a high energy area. The area comprising the eastward bump-out added to Alternative 4 by Alternative 3, moreover, contains only high energy areas. Lower energy areas are to the west of the Channel. As the NMFS letter implicitly concedes, the scour from natural forces in the high energy Channel dwarfs any effect of scallop gear, adverse or otherwise. Furthermore, by definition, scallops are only found in high-energy areas—therefore there will be no adverse effects from scallop fishing on substrate in the productive scallop grounds Alternative 3 would inadvisably include.

It is unclear whether the agency's interest is in protecting the substrate itself—when the larger substrate is not modified by fishing gear—or the epifauna attached to that substrate. To the extent the Channel even supports such epifauna, it is adapted to the high-energy environment. A study by the University of Massachusetts School for Marine Science and Technology ("SMAST") showed that there is no significant difference between changes in fish and macroinvertebrate categories and the density of individuals within each category in areas impacted by the scallop fishery.[7] Therefore, there is no physical or biological benefit to adopting Alternative 3, even with shifted boundaries, as advocated for by the agency.

4. *Alternative 3 Is Impracticable*

In addition to being of limited habitat value, the DEIS clearly states that Alternative 3 fails a practicability analysis: "The magnitude of the loss to the scallop fishery is expected to

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[6] DEIS Volume III at 347.

[7] Kevin D.E. Stokesbury & Bradley P. Harris, *Impact of Limited Short-Term Sea Scallop Fishery on Epibenthic Community of Georges Bank Closed Areas*, 307 Marine Ecology Progress Series 85, 98 (2006).

dwarf the expected moderate positive benefits to the groundfish fishery of habitat conservation in this area."[8] The closure in this alternative would lead to predicted losses of $33 million in the scallop and groundfish fisheries alone—with no benefit gained. Therefore, NMFS's request to consider this alternative lacks any suitable rationale.

B. Georges Bank

1. Statements from the HAPC Designation Are No Longer Supported in the Record

NMFS next makes unnecessarily selective use of the DEIS in arguing for continued closure of the Northern Edge as an HAPC, along with highly productive Georges Shoals fishing grounds to the west. Once again, the fact of a proposed HAPC designation from 2007 settles nothing. Similar to the Great South Channel HAPC rationale, Volume II of the DEIS provides only a vague qualitative justification for the designation of the Northern Edge HAPC on Georges Bank: "[s]everal sources document the importance of gravel/cobble substrate to the survival of newly settled juvenile cod ... Increasing the availability of suitable habitat for post-settlement juvenile cod could ease the bottleneck, increasing juvenile survivorship and recruitment into the fishery."[9] Notably, this 2007 justification was copied verbatim from the 1998 Habitat Omnibus Amendment 1, and contains no more recent scientific information. It goes on to say that "the habitat type is rare relative to the Georges Bank region."[10] These statements are no longer supported in the record, and the more recent analysis contained in the DEIS (including site-specific analytical focus and incorporation of SMAST video data) provide more accurate and more refined ways to achieve the purpose of the EFH regulations and of the amendment.

In fact, a large region of Georges Bank, which is not limited to the Northern Edge, contains high-energy gravel and cobble substrate, as referenced in the DEIS Volume III analysis. There is no information in the DEIS that supports any claim that the Northern Edge has unique qualities that justify its continued closure when other alternatives perform equivalently well in the impact analysis and are more practicable. Although the agency's letter states that "Alternative 7 is not equivalent in terms of habitat protection and thus may not compensate for the adverse effects of opening a portion of the HAPC," as with its Great South Channel advocacy, there is simply no basis for that claim in the record.

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[8] DEIS Volume III at 469.

[9] DEIS Volume II at 384.

[10] *Id.* at 385.

2. The Record Primarily States that Alternative 7 Has Positive or Neutral Impacts

NMFS cannot ignore the eight years of scientific and empirical development since the 2007 re-recitation of 1998 qualitative conjecture supporting the HAPC. The record simply does not support NMFS's argument that Alternative 7 has negative impacts compared to no action. Indeed, NMFS needs to cherry-pick isolated passages of the DEIS to support its ill-founded argument, while the entirety of the record supports the opposite conclusion.

Four passages in the DEIS, as well as the Habitat Plan Development Team's comprehensive report detailing the findings of the SASI model, contain summary information comparing Alternative 7 to No Action. In only one of those five analyses is Alternative 7 described as having "possible slight" negative impacts compared to "no action"—conveniently, that is the passage the agency cited in its letter. The five passages are thus:

- DEIS impacts summary chart: Alternative 7 is keyed as "green plus"—that is, it has positive habitat impacts compared to No Action;[11]
- SASI report: Opening any of the current closures on Georges Bank will substantially decrease total adverse habitat impacts from fishing;[12]
- DEIS description of Alternative 1 habitat impacts: "Alternative 1/No Action probably has neutral seabed impacts... relative to Alternative 7";[13]
- DEIS description of Alternative 6A habitat impacts: "If Alternative 6A is implemented with Option 1 or 2, there would be slightly positive impacts relative to Alternative 1/No Action, given that the 6A area encompasses a larger area containing vulnerable seabed habitats as compared to the existing closure... [6A] would have neutral impacts relative to Alternative 7"[14] (concluding by

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[11] DEIS Volume I at 45.

[12] "For mobile bottom tending gears, which comprise nearly 99% of all adverse effects in our region, allowing fishing in almost any portion of the area closures on Georges Bank is estimated to substantially decrease total adverse effects from fishing... So long as there is agreement that, if areas are opened, catch rates and effort levels for most fisheries are likely to be higher inside these areas than outside, the direction of change in aggregate adverse effect for these various opening scenarios will not change." NEFMC, *The Swept Area Seabed Impact (SASI) Model: A Tool for Analyzing the Effects of Fishing on Essential Fish Habitat* (January 21, 2011), at 234. A Northern Edge scallop access area would be designed specifically to elevate catch levels.

[13] DEIS Volume III at 252.

[14] *Id.* at 254-255.

extrapolation that Alternative 7 is also slightly positive compared to no action); and

- DEIS description of Alternative 7 habitat impacts: "[T]he Alternative 7 areas in combination may not constitute an improvement in conservation related to Alternative 1/No Action, and probably have slightly negative impacts. Alternative 7 probably has neutral impacts to Alternatives 3, 4, 6A, and 6B."[15]

In summary, the following conclusions are drawn. In the DEIS overview, the SASI report, and Alternative 6 analysis, Alternative 7 has slight positive impacts relative to no action. In the no action description, the relative impacts are neutral. Only in the description of Alternative 7 are the impacts characterized as probably slightly negative, and NMFS has provided no rational basis to cherry-pick this sole instance in forming its argument to advocate for both maintaining the Northern Edge closure and extending that closure into productive, currently-fished Georges Shoals areas to the west.

3. Alternative 7 Performs Comparably to Other Alternatives in the DEIS Analysis

Regardless of the documents' contradictory summary conclusions, moreover, what is known is that Alternative 7 performs comparably to the other alternatives using the DEIS's analytical tools, as we have detailed in previous letters and as the DEIS shows. While NMFS would minimize this fact, the Northern Edge contains some of the most productive scallop grounds on the planet. Allowing periodic access to that area, via closely regulated scallop rotational access area management, is fully consistent with the quoted SASI analysis.

For example, none of the Georges Bank habitat management area alternatives contain hotspots for cod. In fact, the huge majority of areas contain hotspots only for haddock, red hake, and winter flounder.[16] Also, the combined vulnerability score of the two areas comprising Alternative 7 is comparable to, or exceeds, that of other proposed HMAs in the management region.[17] Furthermore, Alternative 7 would prohibit scallop fishing in a much greater area of the type of cobble that the agency argues must be protected, compared to no action, since scallop fishing is currently allowed in many areas of Closed Area II.

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[15] *Id.* at 255. Notably, the agency advocates Council consideration of Alternative 6A over Alternative 7, despite this section and the habitat impact analysis for Alternative 6A stating that the two have comparatively neutral impacts.

[16] *Id.* at 318.

[17] *Id.* at 247.

4. Analyses of Impacts Must Be Based on the Selected Alternatives as a Whole

Another major flaw in NMFS's position is that it considers closures on Georges Bank and in the Great South Channel in isolation. If the goal of these actions is to protect the Georges Bank cod stock, all of the impacts must be considered in totality, including what would be new closures in or near the Great South Channel. Each of the alternatives was designed to protect the stock's juvenile life stage, and must therefore be viewed based on aggregate impacts to the stock. This coordinated effort will constitute an improvement in overall management if practicable alternatives, considered as a whole, are adopted that protect key habitat.

C. Resource Productivity

In addition to FSF's concerns over the agency's site-specific errors, NMFS's January 8, 2015, letter also contains several serious mischaracterizations of the scientific analysis behind the DEIS alternatives. Principally, NMFS continues to claim that broad-scale year round closures in New England will demonstrably improve stock productivity. As we have stated throughout the amendment process, there is no scientific data that shows *any* linkage between such closures and groundfish stock productivity. As a matter of historic performance, moreover, the current closures have not appeared to help Georges Bank cod very much, if at all.

The agency relies on this faulty interpretation in most of its arguments. For example, in justifying its position that there should be a closure in the Northern Edge, it states "the Council needs to consider the extent to which continued habitat protection in the status quo habitat management areas would enhance the productivity of groundfish resources, one of the over-riding goals of the amendment." It further states that "[t]he practicability analysis should weigh the economic impacts of the alternatives the stock productivity impacts [sic]." What's more, the DEIS includes a similar statement to explain when EFH designations will influence management decisions.[18]

D. The Scientific Record Should Be Updated, Where Appropriate

FSF urges the Council to consider the best scientific information available in weighing alternatives. In cases where the scientific record has not been updated since 2007, it would be prudent to do so as NMFS has requested—provided that so doing does not unduly delay the implementation of the amendment. In particular, the agency requested that the PDT update the realized Z score from the SASI model using data through 2013. The SASI model will still show

[18] "When EFH designations, collectively or individually, influence fishery management decisions, the intent is to minimize adverse effects of Federal actions on EFH and thereby improve resource productivity and long term benefits to the fishery and fishing communities." *Id.* at 451.

that the best way to decrease swept area, and therefore habitat impacts, is to allow the fishery to operate at the highest catch per unit effort. This would be a useful exercise to ensure that decisions are made on sound science. This will not be accomplished through broad, haphazard year-round closures in the Great South Channel and on Georges Bank.

* * * * *

We appreciate the huge amount of work and thought that both the Council and the agency have already given to this habitat process. Please do not hesitate to contact us if you have any questions or need additional information.

Sincerely,

David E. Frulla
Andrew E. Minkiewicz
Anne Hawkins
Counsel for Fisheries Survival Fund

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NEW ENGLAND FISHERY MANAGEMENT COUNCIL

27 January 2015

Subject: Clarification of scientific issues raised in the 7 January 2015 public comment letter from Dr. David Pierce at Massachusetts Division of Marine Fisheries to NMFS Regional Director John Bullard regarding the Stellwagen DHRA Alternative in the Draft Environmental Impact Statement (DEIS) for Omnibus Habitat Amendment 2 (hereinafter referred as the MADMF letter).

Dear Mr. Stockwell,

Herein I address a number of gross misconceptions and mischaracterizations that appear in the referenced MADMF letter and are used as justification to oppose the proposed Stellwagen DHRA with Reference Area Option 2. From the DEIS,

> *"[t]he purpose of the reference area is to create a site where removals of groundfish are limited, in order to be able to study how the ecology of the reference area may change under such conditions. The two reference area options sub-divide an area of relatively high recreational fishing effort. Siting the reference area in a location with relatively large amounts of recreational fishing will best ensure a contrast in before vs. after conditions. If there are significant ecosystem effects of limiting groundfish removals from the major sources, they will be more likely to be detected with a substantial before/after contrast."*

The issue and need justifying this option is to better understand the direct and indirect effects of predators (i.e., those that feed directly on habitat-forming species such as brachiopods and ascidians, and those that feed on predators of habitat forming species such as seastars and crustaceans), and the consequences of their removal by fishing, on the biological elements of seafloor habitats. While the Council has an ongoing concern with the direct effects of bottom contact fishing gear on habitat, virtually no work has been done to address the impacts that removal of predators play in mediating the dynamics of biological elements of habitat. The only way to address this issue is to minimize fishing mortality to as low as possible within a reference site (i.e., in this case, and within the status quo WGOM Closure regime, is to exclude recreational and party-charter hook-and-line fishing from an area) in order to produce the necessary contrasts in the occurrence of predators.

MADMF rejects the Reference Area option principally for the following reasons:

1. an assumption that Atlantic cod is singularly the predator that can influence the state and dynamics of seafloor habitats,
2. an assumption that the option is based solely on the limited movement rates of Atlantic cod reported in Lindholm and Auster (2003) and Lindholm et al. (2007), and
3. an assessment that those studies in item 2 have fatal flaws such that the conclusions of the authors are erroneous,

therefore there is no viable justification for the option. Items 1 and 2 are simply wrong and the

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identification of a supposed fatal flaw in item 3 is unfounded by their reasoning and unsupported by the data. The author of the letter bases his conclusion on an edifice of misinformation, misinterpretation of the referenced literature and a lack of scholarship related to other relevant published work that informs the problem at hand.

It is unfortunate that addressing these particular issues has to take place in the arena of the public comment process; this is amplified by the influence that MADMF, as a respected research and management institution, can have on the public and Council discourse regarding this and related issues. This is not to say that asking critical questions about supporting science is in any way a bad thing. This is a critical part of the scientific enterprise for both fundamental and applied science as well as its application to natural resource management. However, these issues that are foundational to the development of the referenced alternative should and could have been addressed much earlier in the process, so the discussion could focus on the benefits versus the costs of implementing such actions, not whether or not the alternative is even relevant. Dr. Pierce, as a member of the NEFMC, the body where this option was moved forward, had ample opportunity to bring these issues to the fore at Habitat Committee or full Council meetings, or through queries to the Habitat PDT where this and other alternatives were developed and discussed. The Habitat Committee and PDT had discussions and exchanges at multiple meetings regarding the structure and function of this alternative and sought to minimize the size of the Reference Area and its location in order minimize the impact on stakeholders. This MADMF letter simply adds unnecessary conflict to an already conflict-rich process.

What follows is a detailed refutation of these major assumptions and arguments as well as some clarification of other erroneous points raised by the MADMF letter:

1. The assumption that the PDT considered Atlantic cod as the only predator that can exert direct and indirect predator effects is unfounded. Indeed the operating hypothesis of the PDT is that there are multiple species with movement rates that would yield local ecological effects. In the Stellwagen region of the WGOM Closure (and DHRA Reference Area), those predators include not only Atlantic cod but haddock, spiny dogfish, Atlantic wolffish, cusk, and ocean pout. All are a) caught by recreational fishermen who primarily target Atlantic cod in the area, b) prey upon those species of interest, and c) are in the top 10 species reported in landings from 1996-2005 (USDOC 2008 - SBNMS DEIS). Other benthic feeders observed in this area via direct underwater observation include hake (Urophycis spp.) and various Pleuronectiform flounders (Auster and Lindholm 2005), all species of interest to recreational fishermen.

2. The assumption that movement rates of cod (and the other species identified above) are too high to exhibit an ecological effect in the proposed Reference Area is also unfounded. First, the related assumption as stated in the MADMF letter that animals need to be year round residents in order to exert ecological effects was never stated in the DEIS nor in any PDT discussion as far as I know. I'm unclear where this rumor came from. For this option to be effective the only requirement is that some (not all) fish need to be in the Reference Area long enough to produce an effect through predation that

is in contrast to areas outside the Area boundary. This time period can be on the order of weeks to months. For Atlantic cod, our two studies that were referenced in the letter concluded that a portion of the local Atlantic cod population exhibited "high site fidelity," which translates to time periods for each fish of weeks and up to 120 days in the 2003 study and 95 days in the 2007 work (note that the issues raised about interpreting our tagging data are addressed below). Perhaps more important, however, is the fact that other studies in the region, as well as those in other areas of the North Atlantic, report patterns of movement consistent with those at Stellwagen, effectively rendering the already spurious attack on our two papers moot. These studies too had reported a portion of their tagged animals had moved very short distances from their release location over ecologically relevant periods of time. Of course some animals moved longer distances but were still considered sedentary at the spatial scale of the region. The details are in these papers! For example, a paper by Howell et al (2008) supports this assumption and concludes:

> "[t]he movements of scores of cod populations around the world have been examined. Several studies, including two from Stellwagen Bank in the southwestern Gulf of Maine (Groger et al., 2007; Lindholm et al., 2007), have found that groups of cod in different localities are composed of a mixture of both resident and migratory fish (Neat et al., 2006; Wright et al., 2006; Svedang et al., 2007). The fact that a small portion of the fish tagged in this study [the empirical part of this Howell et al paper] moved long distances, suggests that this is probably true in our study area as well. After reviewing many of these studies, Robichaud and Rose (2004) proposed four migratory behavioral categories based on the degree of site fidelity and homing. "Sedentary" populations are found year-round in a relatively small geographical area. "Accurate homers" display seasonal movements and home to a relatively small area, and "inaccurate homers" display seasonal movements and home to a much broader area. The fourth category ("dispersers") includes populations that move and spawn in a haphazard pattern over large geographical areas. Results of this study indicate that the group of cod in the southwestern Gulf of Maine can be categorized as "sedentary resident".

Other predator species noted above also exhibit low movement rates and sedentary life-styles, at least during significant parts of each year. Cusk, wolffish and ocean pout all exhibit sedentary lifestyles with low movement rates (e.g., Collette and Klein-McPhee 2002, Auster and Lindholm 2005, Templeman 1984, others). Movement patterns for haddock are less clear, although Halliday and McCracken (1970) suggest a portion of haddock populations, like cod, can be considered resident, at least seasonally (Begg 1998). That fish predators can influence benthic communities, including structure-forming seafloor fauna, is well known in general terms (e.g., Ojeda and Dearborn 1991, Witman and Sebens 1992, Steneck et al. 2004). The Reference Area sets the stage for studies that better address this question at deeper depths within the management region.

That the MADMF letter did not acknowledge any of this other supporting work is emblematic of the larger problem with the letter, the strategic omission of key facts and the misrepresentation of others. It also suggests that the interest of the MADMF in the issue espoused by the letter is not nearly as keen as the letter suggests. A more thorough examination of the rationale underlying the DHRA option would have made the poorly conceived attack on our peer-reviewed literature unnecessary. Indeed this option could have been developed even with the total absence of the Lindholm papers based only upon this litany of scholarly work (those studies cited above and references therein).

3. The issues raised regarding tag retention, loss and detections are spurious. We did not conduct a field study to assess tag loss and, while it would have been nice, it wasn't necessary. Tag loss studies are critical when tag return data (physical tags or acoustic tags) are used for population estimates. They are not critical for studies focused on some questions regarding fish movement. The data reported in both our papers were aggregated up to hours or days for analysis. However, prior to that data aggregation it is possible to identify patterns in tag returns from lost tags within the receiver network. Further, while any tag loss outside the receivers eliminates detection of animals returning to the network, it has the effect of minimizing the percentage of "local" animals versus producing an overestimate. In a preliminary lab study we found zero loss with careful tag emplacement, and no observed changes in fish behavior following tagging. Further, we did consider tag loss when interpreting our data, and for those animals that stayed within the range of receivers in both studies, all tags exhibited "behaviors" consistent with live fish. Animals came and went from the receiver, with some fish traveling between receivers. Even those fish with the most consistent presence in the network exhibited behaviors on a daily basis, inconsistent with a pattern expected due to tag loss. If an animal died or a tag was lost at any of the receivers, the variation in the tag detections would have exhibited much different patterns from those observed (e.g., a tidal signal for tags responding to current patterns, constant signal from one lodged in the rocks modified by signal dropouts). Even assuming we did not detect lost tags based on our iterative assessment approach, it would be those few fish with the longest daily presence, and would not change our overall conclusions. The probability that all animals lost tags is unlikely in the extreme.

Perhaps the tagging experience of the MADMF and SMAST people as quoted in the letter is based on the way they seem to handle tagged fish. In our study, we took time to minimize trauma from capture, tagging, recovery (removal of injured fish), and return to depth in a customized elevator device for release (as detailed in the 2003 paper). Based on images in publications and on the web, it appears animals in MADMF studies are captured, tagged and then haphazardly tossed into the water at the surface, a protocol I'm not sure I could get past my Institutional Animal Care and Use Committee (e.g., see an airborne fish as it is released at: http://stellwagen.noaa.gov/library/pdfs/enotes_mar2014.pdf).

In closing, I acknowledge a personal desire to respond as a co-author of the works referenced in the MADMF letter and as one of the members of the Habitat Plan Development Team who, together with colleagues, crafted the option (although this is my own communication and does not necessarily represent the opinions of other PDT members, the NEFMC or my affiliated institutions). It is unfortunate that this discussion about the scientific foundations and justifications for the alternative, with a voting Council member, had to take place this late in the process and in this forum. Admittedly, the details in the DEIS are scant and need to be addressed in more detail, but in any case, there were ways to go about this that could have engendered this discussion and provided a higher degree of clarity much earlier. With this communication I hope the subsequent discussion can address the benefits and costs of setting the stage, with the DHRA Reference Area, to produce information that clearly has importance for the Council and the stakeholders it serves.

Thank you, in advance, for your consideration. I would be pleased to discuss this matter further and clarify any additional issues.

Sincerely,

Peter J. Auster, PhD
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and
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cc:
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DEC 5, 2014
NEW ENGLAND FISHERY MANAGEMENT COUNCIL

Imaging Surveys of Select Areas in the Northern Gulf of Maine for Deep-sea Corals and Sponges during 2013-2014.

Report to the New England Fishery Management Council - 1 December 2014.

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Since the late nineteenth century, deep-sea octocorals were known to occur in the Gulf of Maine region; specimens collected during early natural resource expeditions as well as by fishermen as bycatch were contributed to natural history museums (Watling and Auster 2005, Gass and Willison 2005). Early ecological studies (e.g., Wigley 1968, Theroux and Grosslien 1987) listed corals as a common component of the hard bottom faunal assemblage in the Gulf of Maine. However, it appears that coral distributions have contracted significantly since then and are now limited to small refugia in rocky areas (Watling and Auster 2005; Auster 2005, Auster et al. 2013, Cogswell et al. 2009).

To inform discussions of deep-sea coral management and fish habitat usage, we are providing the New England Fishery Management Council with a brief review of research surveys conducted in 2013 and 2014. These surveys identified coral-dominated communities in U.S deep waters (200-250 m depth) of the northern Gulf of Maine. This report focuses only on geographic distributions of octocorals based on direct observations. Detailed analyses of imagery to determine fine-scale attributes of coral and sponge distributions in relation to geology, benthic community composition, species associations, and coral size structure are ongoing. Additionally, coral samples were collected for taxonomic, reproductive biology, age-size, and population genetics studies. Results from all projects will be reported as they are completed.

Two different camera platforms were used to assess the presence and composition of coral communities. Both platforms were outfitted with real-time color video and digital still photographic imaging equipment. A 14-day cruise (11-24 July 2013) aboard the RV *Connecticut* utilized the University of Connecticut's ISIS2 towed camera sled. Thirty-five ISIS camera tows were conducted in four areas (Western Jordan Basin, Mount Desert Rock, Outer Schoodic Ridge, off Monhegan Island; Figure 1). A second cruise (23 July - 6 August 2014) aboard the RV *Connecticut* employed the ROV Kraken 2. During this cruise, 21 ROV dives were conducted in three areas (Outer Schoodic Ridge, Western and Central Jordan Basin; Figure 1).

Previous surveys in the region guided the selection of survey sites in 2013. Initial investigations using ROVs in 2003 and 2004 documented a limited number of locations with dense coral communities (e.g., Auster 2005, Watling and Auster 2005). During a cruise of the NOAA Ship *Ronald H. Brown* during 2005, preliminary multibeam sonar data was collected in Western Jordan Basin and revealed that hard substratum in the immediate area around one of those sites (i.e., around the 114 Bump site indentified in 2004-2004) was more spatially extensive than previously suspected (Watling and Auster, unpublished). Using these data and a detailed bathymetric chart of the Jordan Basin-Mount Desert Rock-Schoodic Ridge regions (Fisheries and Oceans Canada LC 4011), we selected areas of steep topographies in depth ranges where corals were expected to occur (i.e., the deeper depths of Maine Intermediate Water and Maine Deepwater regimes). These initial surveys and mapping efforts, along with historical records (Watling and Auster 2005, Packer et al. 2007, in review), were the basis for the current coral zone alternatives for the northern Gulf of Maine region, as described in the June 2012 Draft Deep-Sea Coral Management Alternatives (Figure 3; NEFMC 2012).

Much needed high quality multibeam data were recently collected in the region after our 2013 survey. Maps of the two primary survey areas (i.e., Western Jordan Basin and Outer Schoodic Ridge) were produced during a collaborative effort with the Ecosystem Monitoring group of NEFSC and NOAA's Office of Exploration and Research (OER) during the fall 2013 ECOMON cruise aboard the NOAA Ship *Okeanos Explorer* (Figure 4 a,b). Thus, selection of ROV dive locations in 2014 were based on topographic features illustrated in these detailed maps. A map of the Central Jordan Basin dive site, immediately along the U.S.-Canada boundary, was produced during a June 2014 cruise (HB1402) of the NOAA Ship *Henry B. Bigelow* (Figure 4c). Based on these data, we conducted one dive in the Central Jordan Basin region in 2014. Time constraints prevented additional investigations. No dives were made at Mount Desert Rock during 2014.

Results of our surveys revealed extensive coral cover in our two primary survey sites (Western Jordan Basin and Outer Schoodic Ridge; Figure 5). This pattern is somewhat biased given that we focused our efforts on topographic features that we reasoned could support coral communities in order to increase the likelihood that coral habitat would be discovered. As the map indicates, other areas in the region, such as Mount Desert Rock and Central Jordan Basin also have coral communities. Although habitat suitable for coral colonization appears to be more patchy in these areas than in the primary survey areas, additional work is needed to better define the extent of coral habitat. The spatial extent of surveys in these areas were inadequate due to limited dive time. (Note: we only report octocoral data here, as this is the primary focus and defining rationale for the coral omnibus amendment.)

Structure-forming corals at all sites were predominantly octocorals (Subclass Octocorallia, Order Alcyonacea), although scarce numbers of tiny, stony cup corals (Subclass Hexacorallia, Order Scleractinia) were observed on some dives. We classified coral occurrences as either coral present (sparse to medium density) or coral garden (high density patches). Coral gardens are defined as areas where octocorals are among the dominant fauna and occur at densities higher than surrounding patches (Bullimore, Foster, and Howell 2013). Based on ISIS2 imagery in 2013, areas in Western Jordan Basin, off Mount Desert Rock, and Outer Schoodic Ridge with steep and short vertical rock faces (ca. 2-4 m maximum height) had higher densities of octocorals (primarily *Paramuricea placomus* with lower abundances of *Primnoa resedaeformis* and *Acanthogorgia* cf. *armata*) than nearby areas with less vertical relief (Figure 6). Density of coral colonies on these rock faces, calculated using 20 cm parallel laser dots to calibrate the area of digital still images, had highest density values of 15.7–38.6 colonies m^{-2}. These density values are well above the threshold of 0.1 colony m^{-2} used by ICES (2007) to define coral garden habitat. Areas adjacent to these steeper features as well as open muddy areas containing gravel, sand-gravel, and emergent rock outcrop features (with shallow expressions above the fine-grain sediment horizon), supported lower densities of coral (primarily *P. placomus*). Corals in these low relief environments co-occurred with other attached and emergent structure-forming fauna (e.g. burrowing anemone *Cerianthus borealis*, sea pen *Pennatula aculeata*, sponge *Polymastia* sp. and other sponge taxa).

Surveys with the highly maneuverable Kraken 2 ROV during 2014 revealed additional coral-dominated sites as described above (Figure 7). Tall vertical rock walls in the Schoodic Ridge area with extremely dense and spatially extensive communities dominated by *Primnoa resedaeformis* were also observed (Figure 8). The geologic setting in Schoodic is unique, and analogous in topographic structure to slot canyon morphologies found on land (e.g., in the western United States). Coral colonies were so dense in most of these settings it was impossible to identify and count individual colonies. The vertical walls had the highest coral cover of any area along Outer Schoodic Ridge. One discrete community measured approximately 42 m horizontally x 12 m in height based on ultra-short baseline acoustic tracking and Kraken 2 altitude sonar data.

A site in Central Jordan Basin was added to the 2014 cruise to survey areas likely to support corals in U.S. waters along the U.S.-Canada boundary. The single dive revealed low-density patches of *Paramuricea* on lower vertical relief rock outcrops and mud-covered gravel (Figure 9). (In June 2014 scientists aboard NOAA Ship *Henry B. Bigel*ow cruise used the Canadian ROV ROPOS to investigate deep-sea coral habitats and associated fauna in submarine canyons and the Gulf of Maine on both sides of the international boundary. Only one ROPOS dive, south of the study site reported here, was conducted in U.S. waters of Jordan Basin. Results of the *Bigelow* cruise will be reported elsewhere.)

In all areas surveyed, sponges and anemones often occurred in high density patches amongst the more extensive corals on walls and on steep features without corals (Figure 10). Sea pens also occurred in dense patches in mud and gravel-mud habitats adjacent to hard substratum habitats. Sea pens have been documented to serve as habitat for larval redfish in Canadian waters (Baillon et al. 2012).

Pandalid shrimp, amphipods, and aggregations of krill (*Meganyctiphanes norvegica*) were commonly associated with coral communities along steep walls. Acadian redfish used coral for shelter whereas Atlantic cod (juvenile and adult size classes), cusk, goosefish, pollock, silver hake and spiny dogfish were observed searching for and catching prey (i.e. pandalid shrimp, krill, small fish) near and amongst coral colonies (Figure 11). Corals also provided flow refuges for fishes from tidal generated currents. Crustacean taxa (American lobster *Homarus americanus*; king crab *Lithodes maja*) occurred in association with structure-forming organisms on the seafloor, including corals, and were observed foraging amongst these features as well.

Noteworthy is the first documentation of the occurrence of *Anthothela grandiflora* in the Gulf of Maine (Figure 12). This species has been observed off the Northeast Channel along the continental margin at depths deeper than 1400 m (Cogswell et al. 2009). Also, we observed the sea star *Hippasteria phrygiana* preying on *Primnoa*. These predation events occurred on living coral colonies that had been detached from rock walls and were laying on the seafloor (Figure 13).

Areas exhibiting recent direct impacts from fishing activities were observed at sites in Western and Central Jordan Basin and Outer Schoodic Ridge. In steep areas, paths or tracks, consistent with setting or recovery of trap gear, were denuded of corals and associated fauna (Figure 14a-c). The peaks of some ridges and nearly horizontal sections of wider outcrops were also denuded. Tracks observed here were consistent with impacts from mobile fishing gear (Figure 14d-e). Some coral patches exhibited damage to large but still living colonies. Smaller colonies were also distributed within the patch, producing a disjunct size class structure, and suggesting previous impacts with subsequent recruitment (Figure 14f).

Here we have summarized results from recent research cruises focused on deep-sea coral resources within the northern Gulf of Maine region with the intent to provide the Council with improved information for conservation and management. This project principally addressed the "Exploration and Research" goal of NOAA's Deep Sea Coral Research and Technology Program (DSCRTP)(NOAA 2010) and the specific objectives to: "locate and characterize deep-sea coral and sponge ecosystems, understand the biology and ecology of deep-sea corals and sponges, understand the biodiversity and ecology of deep-sea coral and sponge ecosystems, and understand the extent and degree of impact to deep-sea coral and sponge ecosystems." Meeting these objectives links directly to the second DSCRTP goal of "Conservation and Management." Data collected provides information needed to inform the management process to protect coral communities from fishing gear impacts and conserve those areas not currently fished. This work also meets NOAA's long-term mission Goal #3 focused on "Healthy Oceans." In particular, research and information products that result from this deep sea coral survey effort will directly inform NOAA Fisheries and the New England Fisheries Management Council and improve conservation and sustainable use of "[m]arine fisheries, habitats, and biodiversity ..." by aiding development of management alternatives related to deep sea corals and essential fish habitat.

Highest abundances and diversity of deep-sea corals off the Northeast United States occur in deep submarine canyons and seamounts far offshore along the edge of the continental shelf (Packer et al. 2007). That said, the extremely high densities observed for at least two large-sized, structure forming species of corals in the relatively shallow waters of the Gulf of Maine is unique. The proximity of these habitats so close to shore increases the potential role of these habitats to function as EFH (e.g., Auster 2005). Finding these spectacular walls of corals in the Gulf of Maine for the first time in 2014, after 40-plus years of submersible surveys, illustrates how much more we need to understand about the Gulf of Maine ecosystem in order to better conserve and manage our natural resources.

Acknowledgements

This work was funded by the National Oceanic and Atmospheric Administration's Deep Sea Coral Research and Technology Program through NOAA Grant NA13NMF4720187, NOAA Contract EA-133F-14-SE-3060, and NOAA Grant NA14OAR4320158 through the Cooperative Institute for North Atlantic Region. We thank the crews of the RV *Connecticut* as well as the ISIS 2 and Kraken 2 underwater vehicles for exceptional support in the field. The opinions expressed herein are those of the authors and do not necessarily reflect the opinions of NOAA or its sub-agencies.

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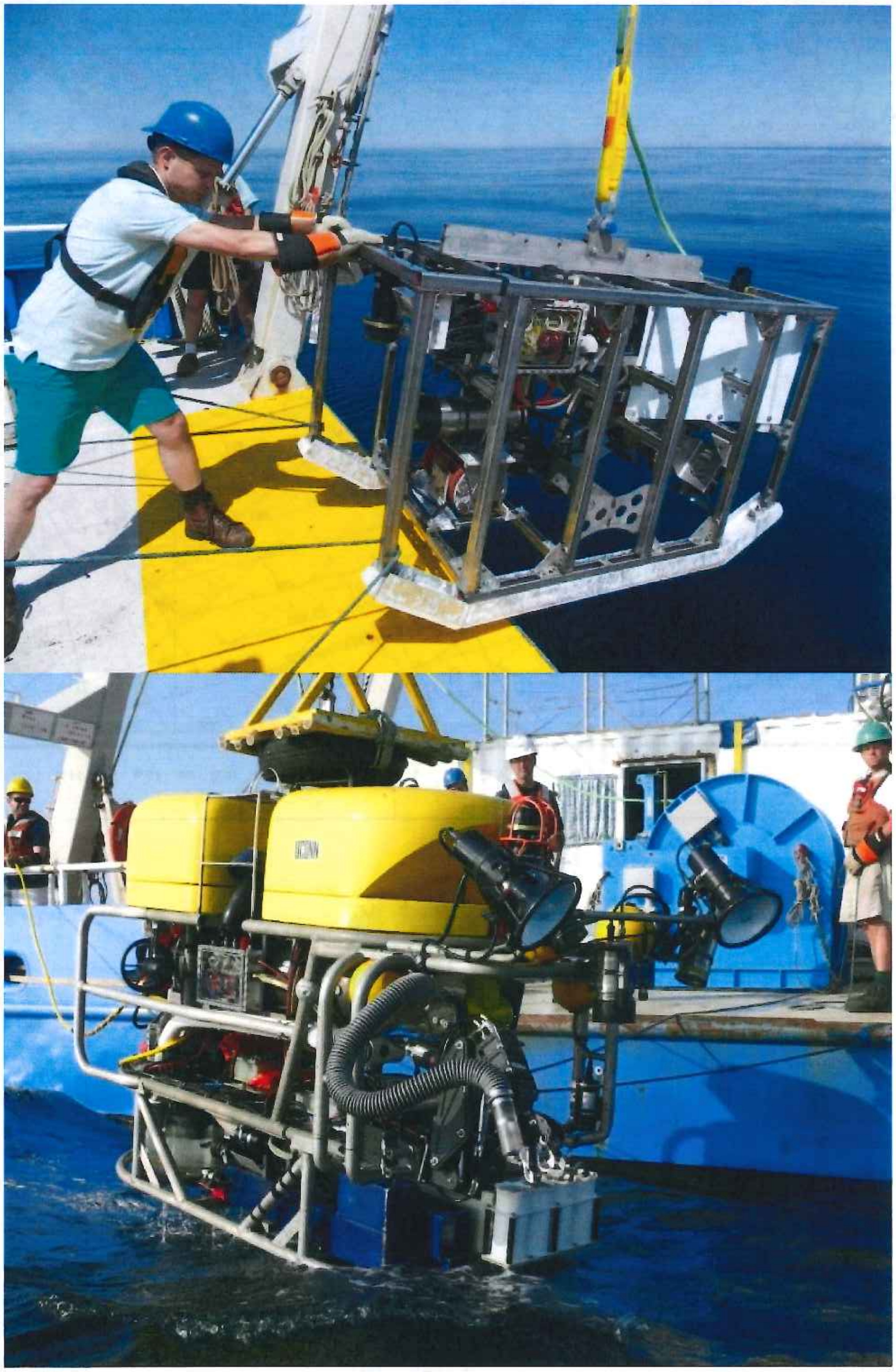


Figure 1. (Top) Instrumented Seafloor Imaging System 2 (ISIS 2) and (bottom) Kraken 2 Remotely Operated Vehicle (ROV). Both systems have forward and down-looking video and digital photographic capabilities. ISIS 2 can be rapidly deployed and recovered but can only maneuver in X-Y directions along complex seafloor via ship movement using dynamic positioning, with depth adjusted via shipboard winch. This system is limited to imaging tasks. Kraken 2 has more complex launch-recovery requirements but is able to finely maneuver for imaging as well as to collect and store samples with a manipulator arm and suction sampler.

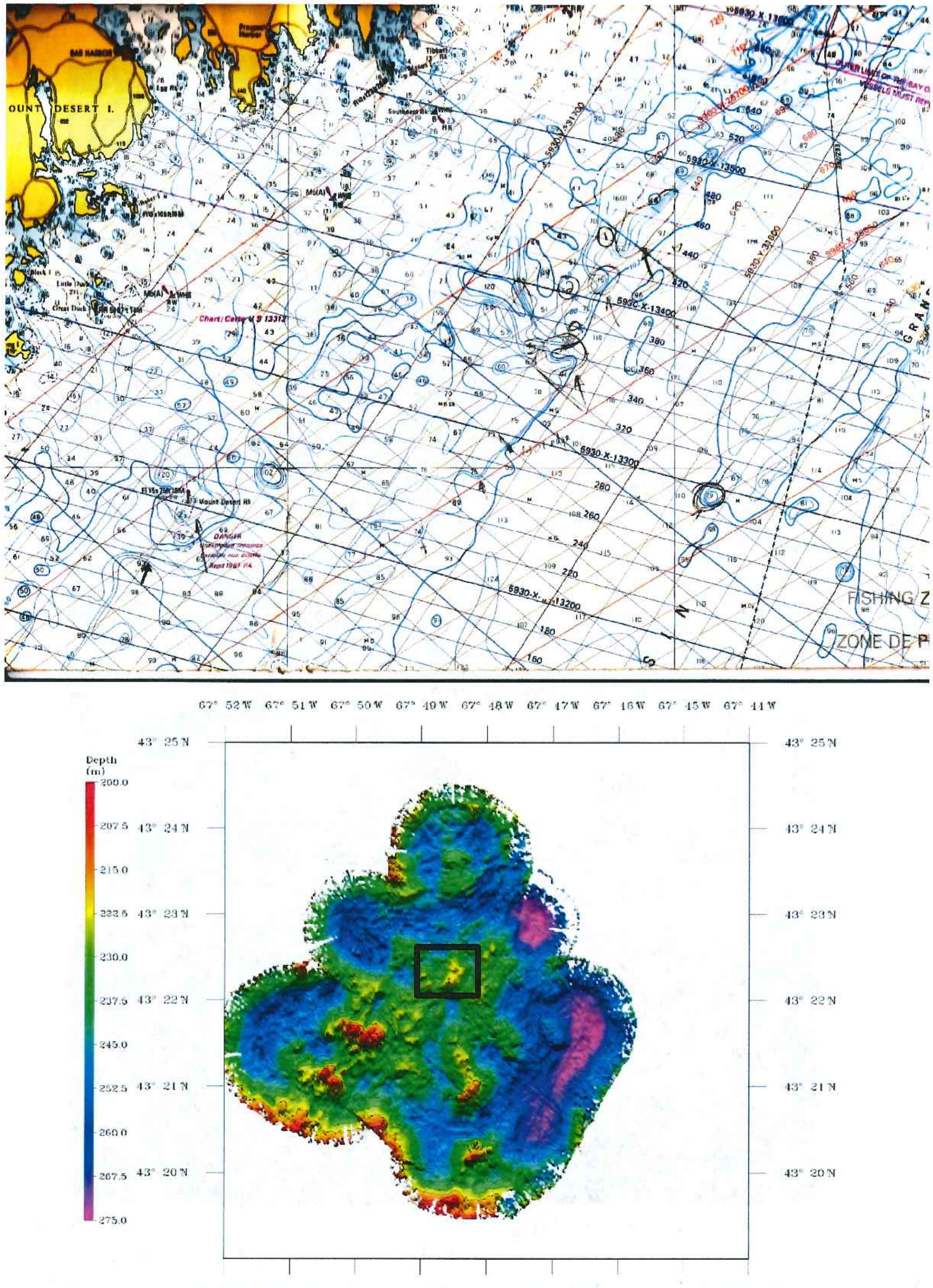


Figure 2. (Top) Bathymetric chart of Mount Desert Rock – Schoodic Ridges region (Fisheries and Oceans Canada LC 4011) used to identify 2013 ISIS2 camera tow stations along areas of steep topography. (Bottom) Multibeam bathymetric map from NURP-UConn 2005 NOAA Ship *Ronald H. Brown* cruise. The 114 Bump site, identified during 2003-2004 cruises in Western Jordan Basin, is indicated by the box.

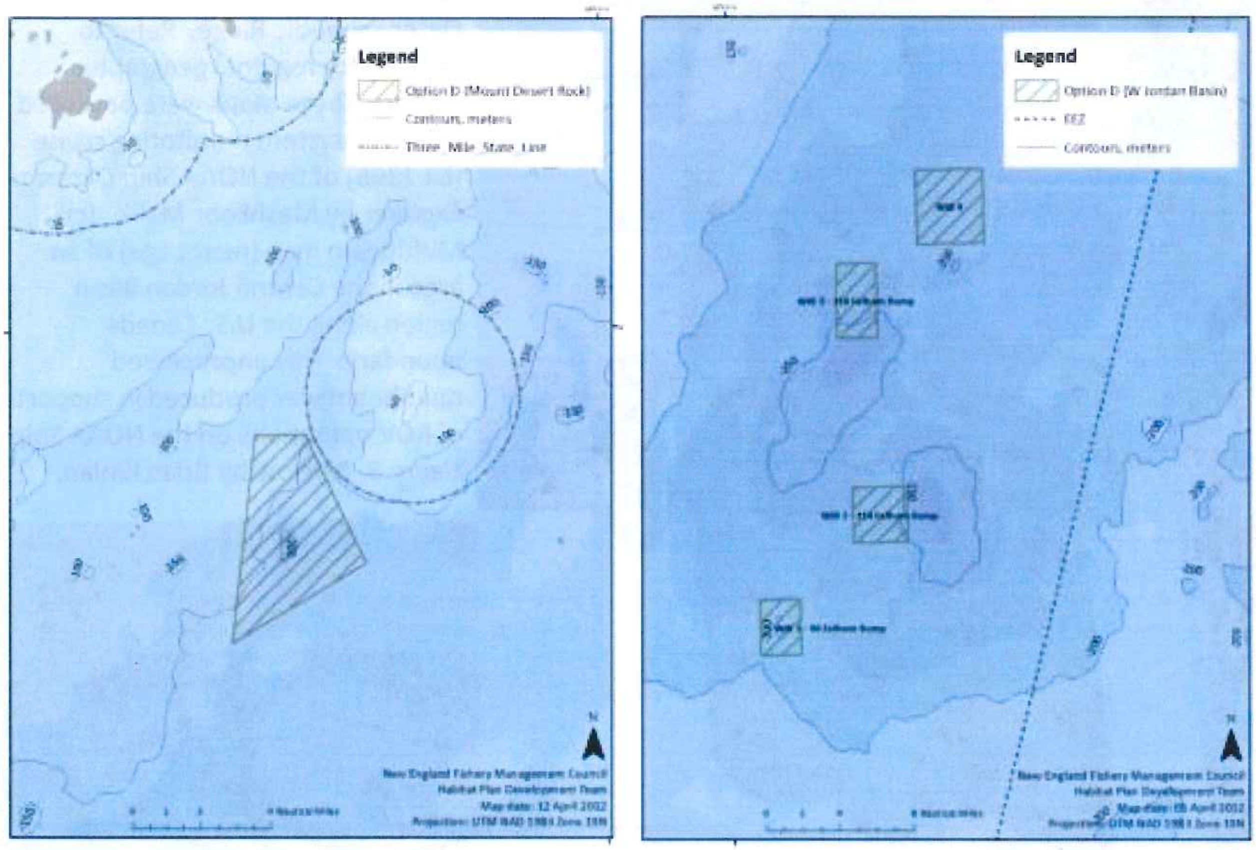


Figure 3. Maps of current draft alternatives for discrete deep-sea coral zones in the Gulf of Maine: Mount Desert Rock area (left) and Western Jordan Basin (right). Source: Maps 12 and 13 in NEFMC June 2012 Draft Deep-Sea Coral Management Alternatives.

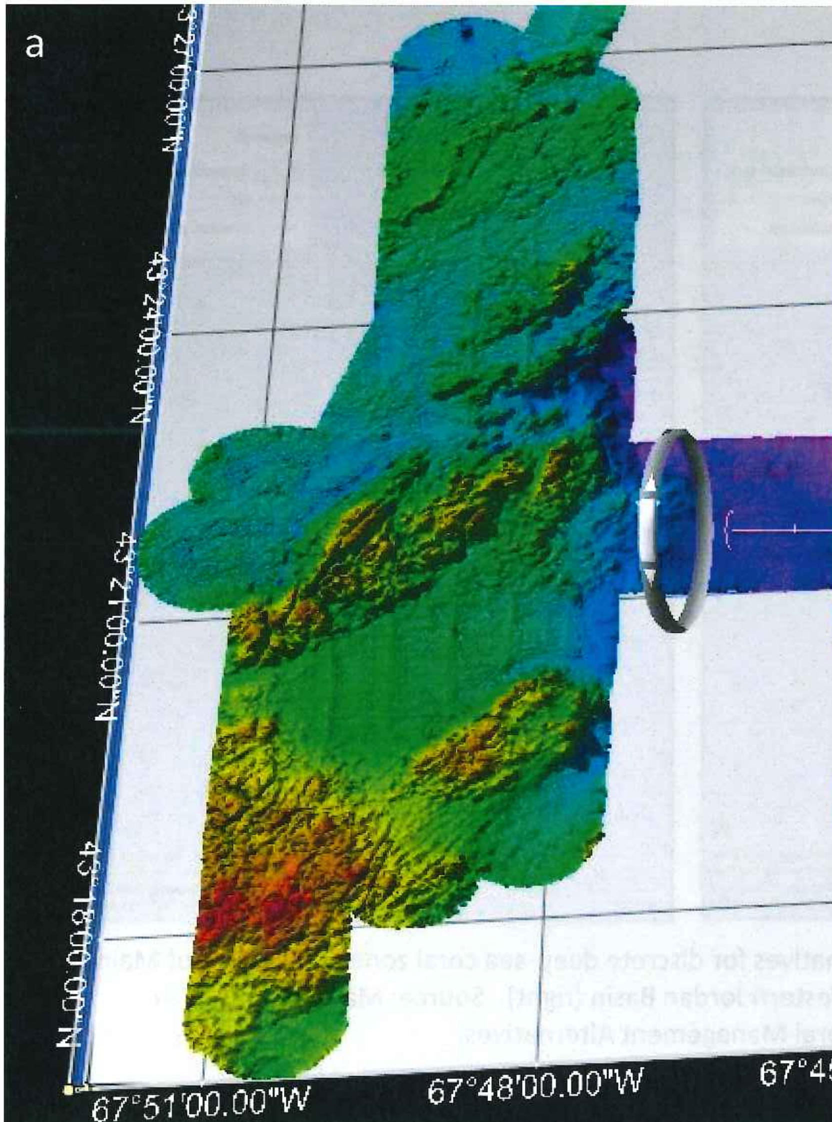
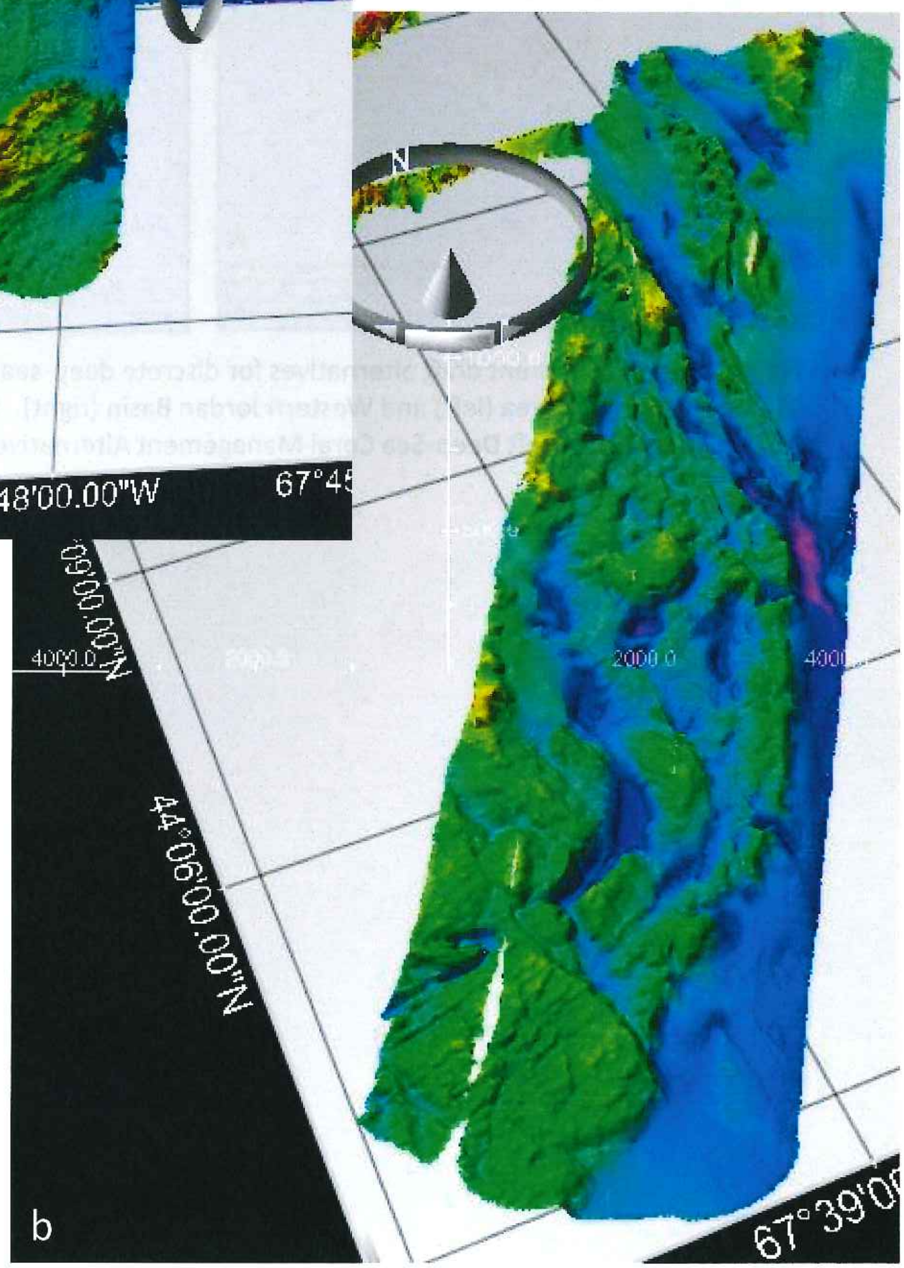


Figure 4. Detailed multibeam maps of (a) Western Jordan Basin and (b) Outer Schoodic Ridge. Refer to Figure 3 for regional geographic setting. These maps were produced on an ecosystem monitoring cruise (EX 1305) of the NOAA Ship *Okeanos Explorer* by Mashkoor Malik. (c) Multibeam map (next page) of an area in the Central Jordan Basin region along the U.S.-Canada boundary. This unprocessed multibeam was produced in support of ROV operations on the NOAA Ship *Henry B. Bigelow* by Brian Kinlan.



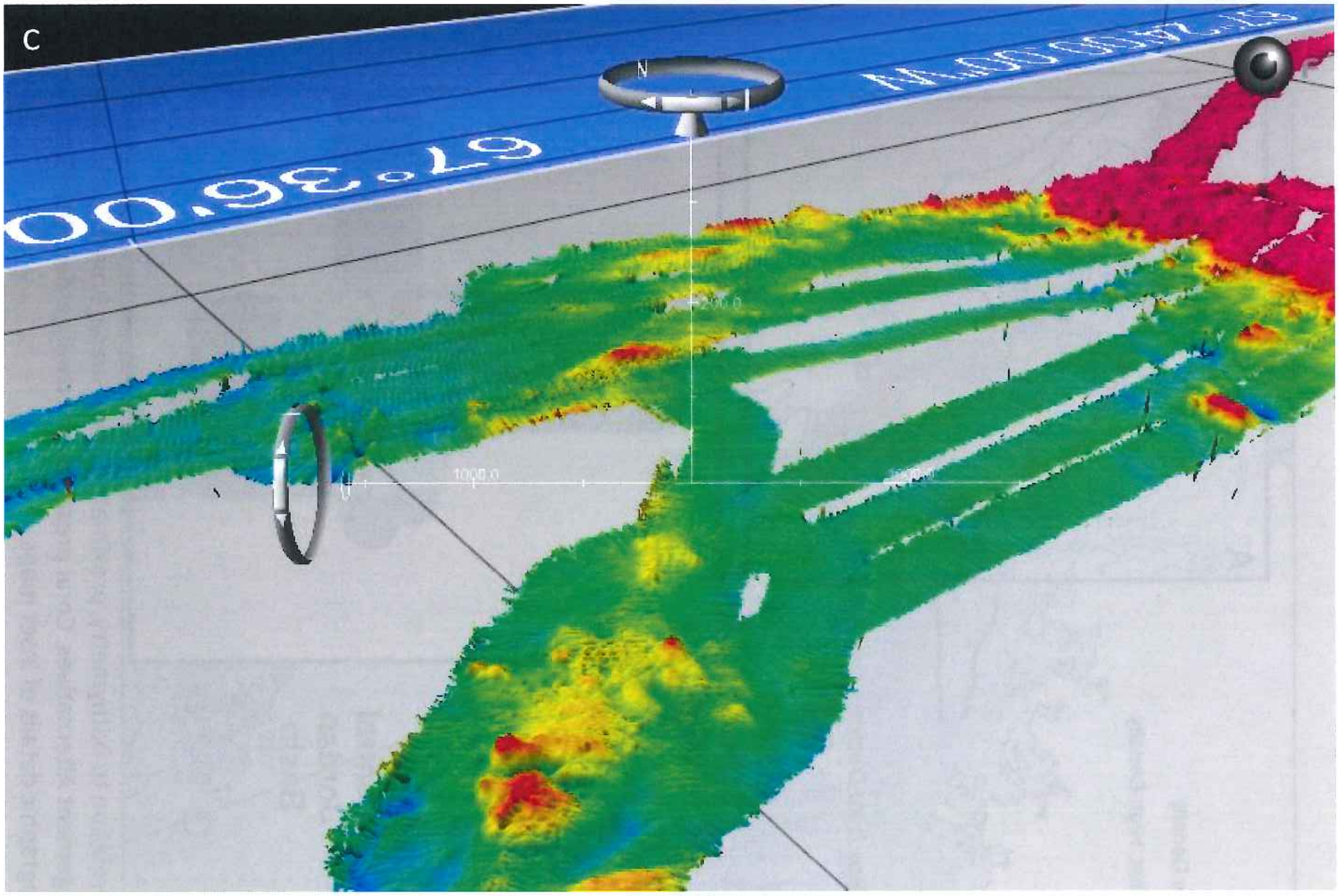


Figure 4. continued

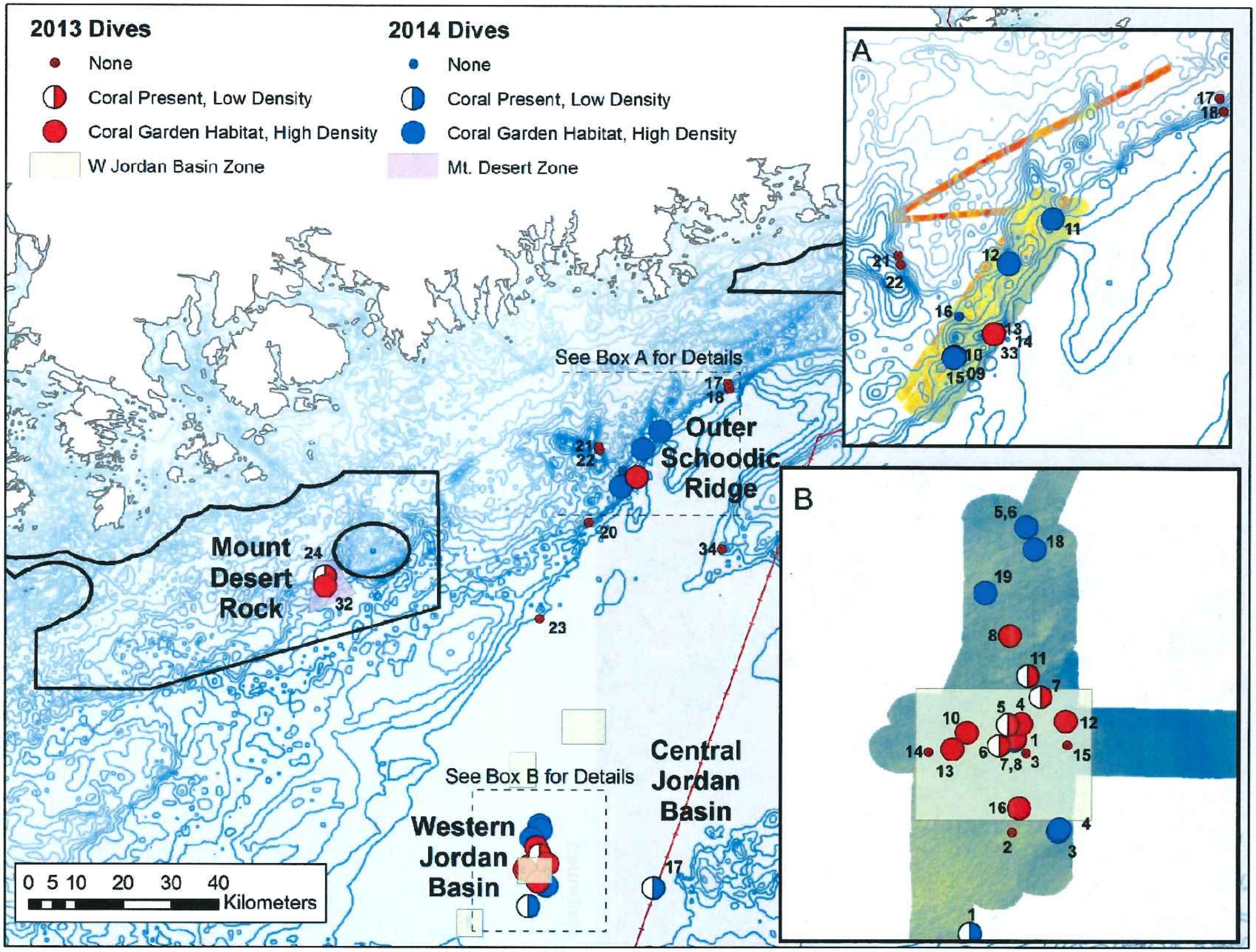


Figure 5. Location of ISIS 2 tows (2013) and Kraken 2 dives (2014) in relation to bathymetry, proximate habitat management alternatives in Omnibus Habitat Amendment 2, and the Draft Deep-Sea Coral Management Alternatives. Coral presence and coral garden classifications are based on definitions in the text. Refer to Figure 4 for multibeam topographic details of inset maps.

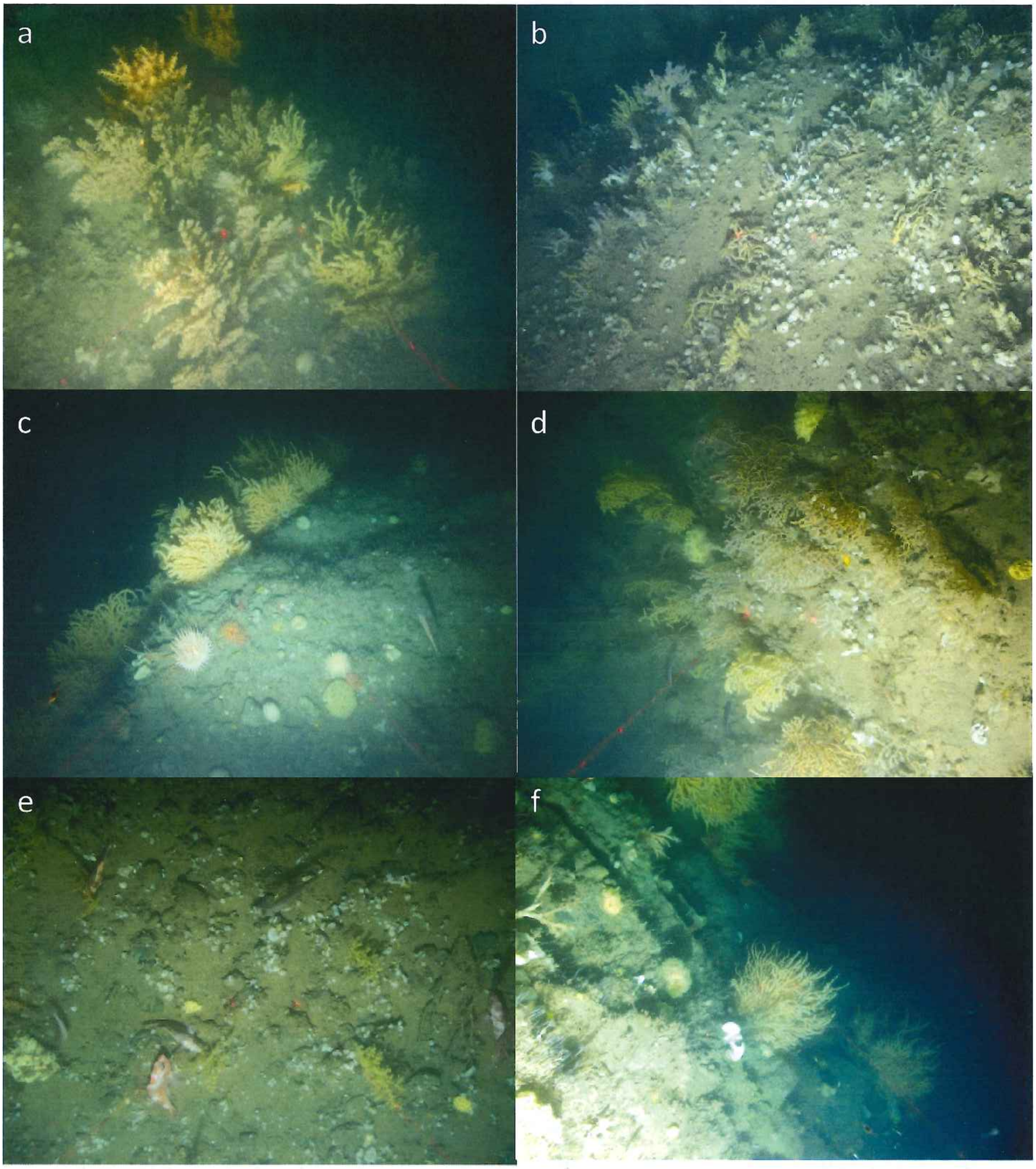


Figure 6. Figure 6. Down-looking images from ISIS2 2013 cruise with 20 cm parallel laser dot spacing of (a) *Paramuricea placomus* (yellow), *Primnoa resaediformis* (orange), and perhaps *Acanthogorgia cf. armata* (brown) along a steep escarpment in Western Jordan Basin. (b) mostly *P. placomus* distributed along sloping rock face with brachiopods in Western Jordan Basin. (c) View from rock crest illustrating *P. resaediformis*(?) on vertical wall at Outer Schoodic Ridge. (d) Color morphs of mostly *P. placomus* at Outer Schoodic Ridge. (e) *P. placomus* on coarse gravel at Outer Schoodic Ridge. (f) Large colonies of *P. resaediformis*(?) along rock wall off Mount Desert Rock.

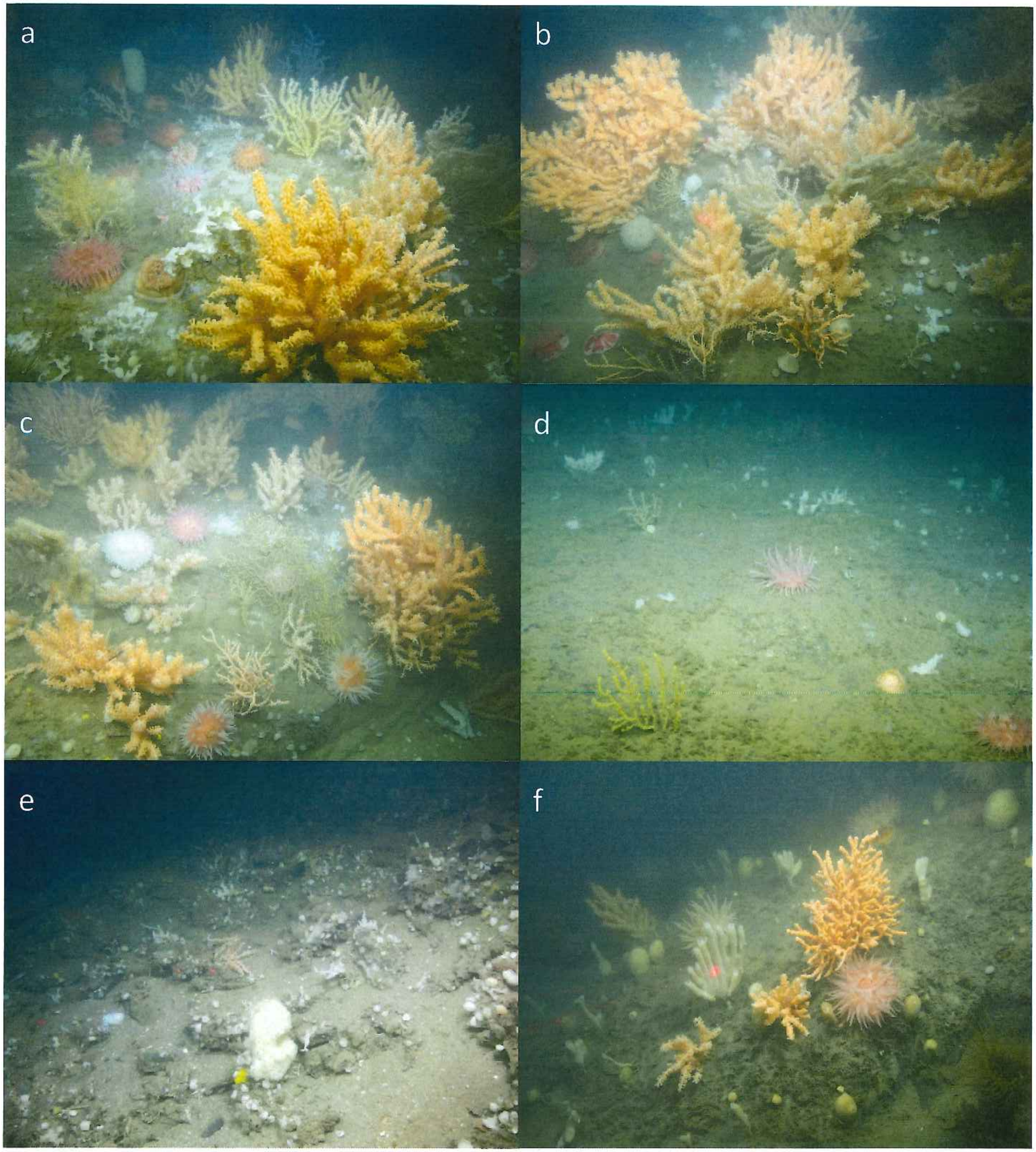


Figure 7. Examples from additional stations during the 2014 cruise illustrating coral garden and sparse coral habitats. All oblique images from Kraken2 with parallel laser dots at 10 cm spacing. (a-c) Dense garden habitat including *Primnoa resaediformis and Paramuricea placomus* in western Jordan Basin. (d) Sparse *P. placomus* distributed along horizontal outcrop in western Jordan Basin. (e) Sparse *P. resaediformis* on gravel pavement below vertical wall at Outer Schoodic Ridge. (f) Corals and sponges at Outer Schoodic Ridge.

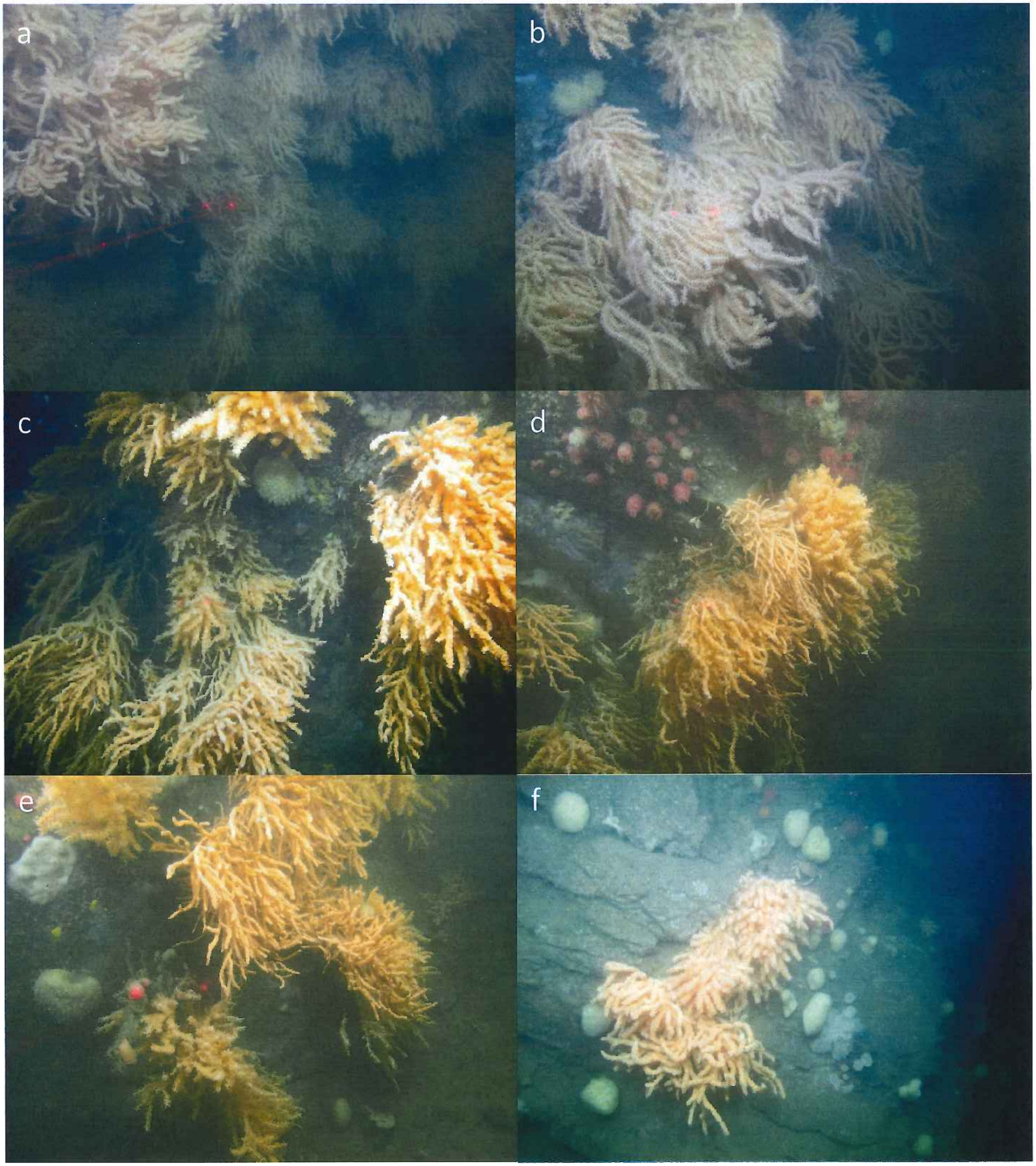


Figure 8. Examples of coral garden habitat seen during 2014 formed by *Primnoa resedaeformis* on near vertical rock walls along Outer Schoodic Ridge. Laser dots are 10 cm apart. (a, b) Example of dense and continuous coverage of *P. resedaeformis* along rock walls. (c-e) Examples of discontinuities in coral cover. Sponges and anemones utilize spaces in these gaps. (f) Patch of coral amongst larger patch of sponges and other attached fauna.

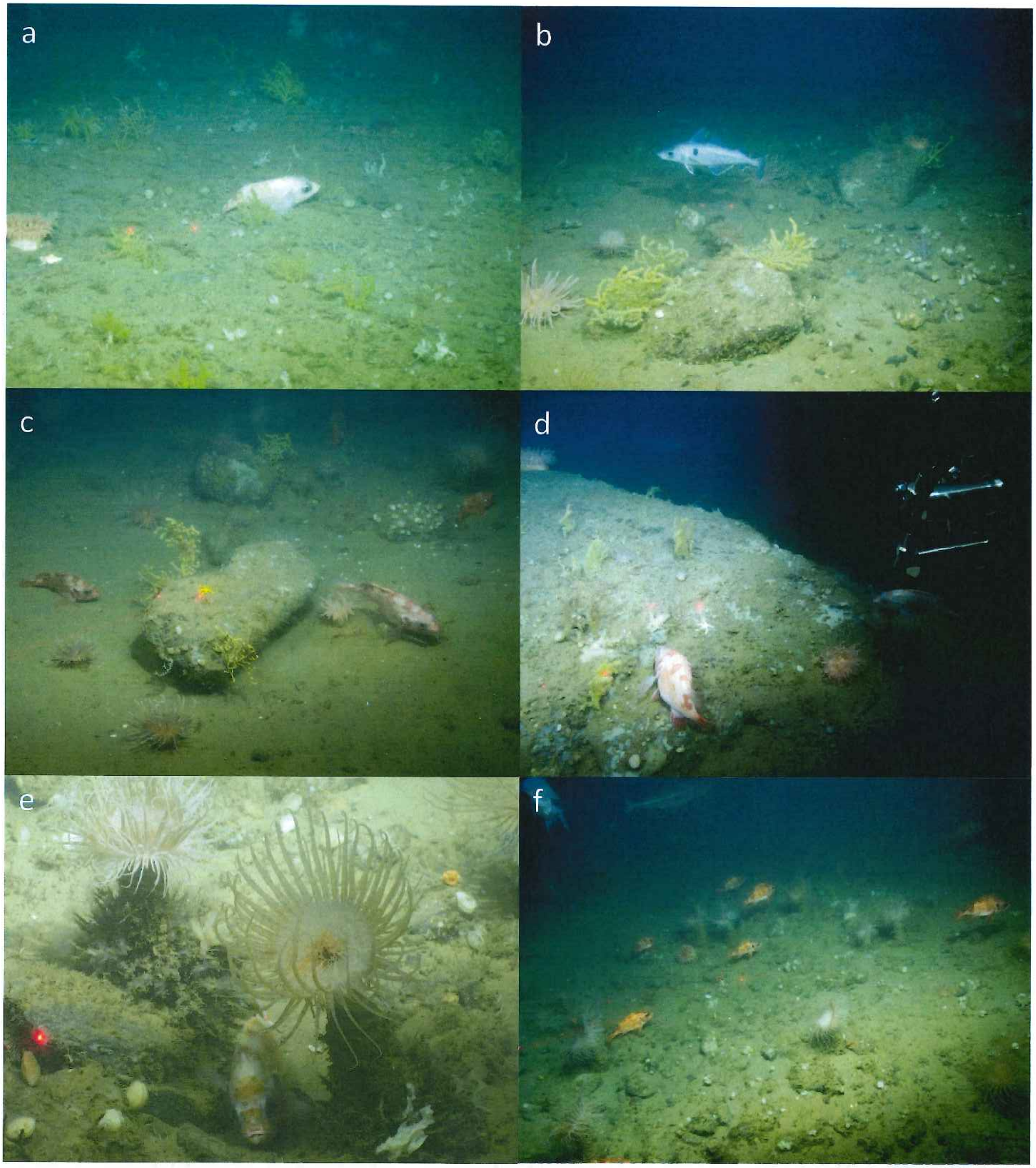


Figure 9. Examples of coral distribution, primarily *Paramuricea placomus*, at the Central Jordan Basin site during 2014. Laser dots are 10 cm apart. (a) Example of low density corals on gravel pavement. (b, c) *P. placomus* on scattered boulders distributed on mud draped gravel. (d) Coral and other attached fauna on rock outcrop. (e, f) The burrowing anemone *Cerianthis borealis* also serves as a primary structure forming organism in muddy areas.

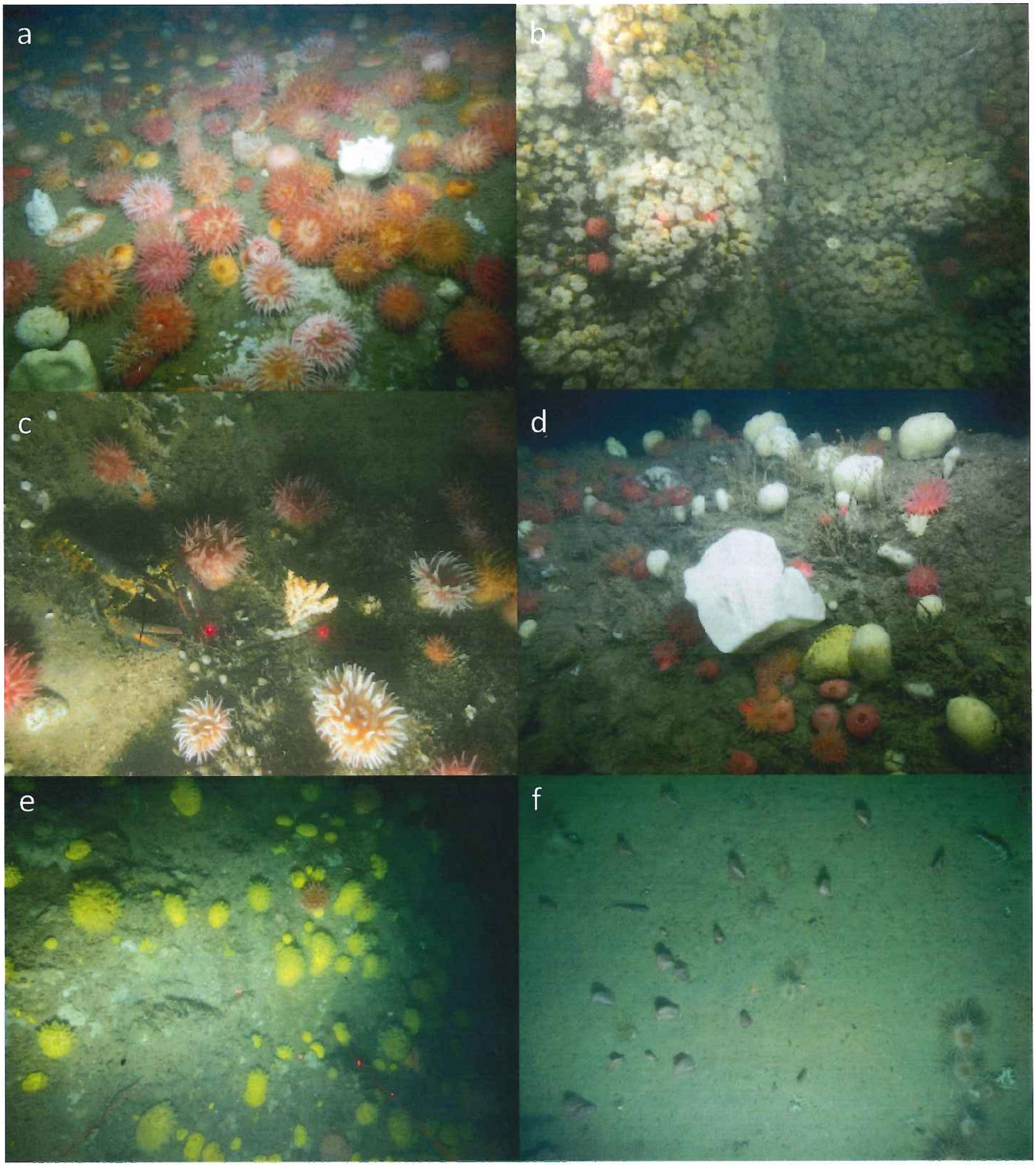


Figure 10. Examples of dense patches of other structure forming fauna from 2013 (laser dots 20 cm apart) and 2014 (laser dots 10 cm apart) surveys. (a) Anemones and sponges, Western Jordan Basin, 2014. (b) Anemones on vertical wall, Outer Schoodic Ridge, 2014. (c) *P. resedaeformis,* lobster, and anemones, Western Jordan Basin, 2013. (d) Sponges (*Polymastia* and *Phakellia* among them) and anemones, Outer Schoodic Ridge, 2014. (e) *Polymastia* sponges and anemones, Outer Schoodic Ridge 2013. (f) Sea pens (*Pennatula aculeata*) and burrowing anemones on mud bottom, Outer Schoodic Ridge 2013.

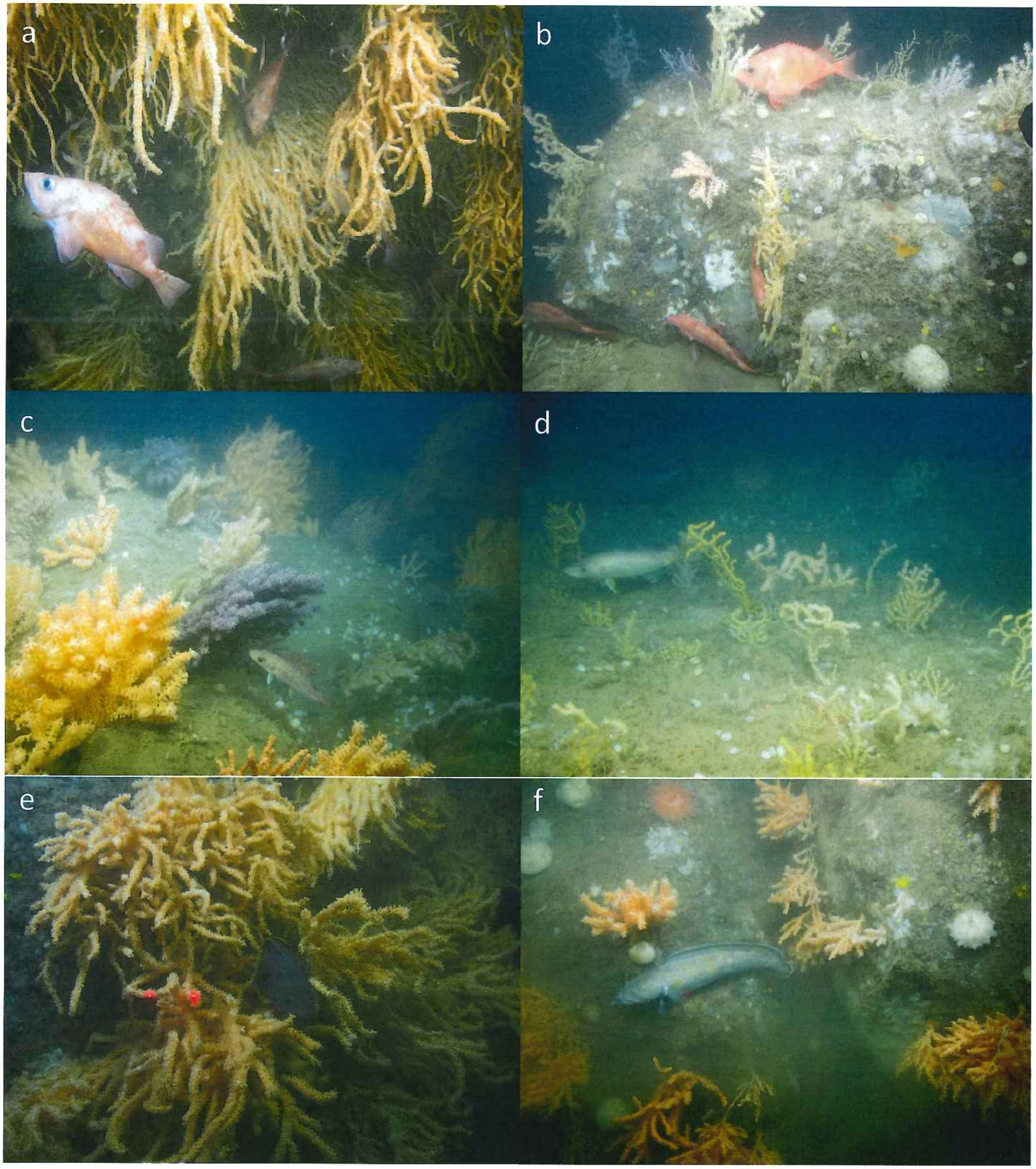


Figure 11. Examples of fish associations with coral habitats. All from 2014 surveys (laser dots 10 cm apart) except (h) from 2013 (laser dots 20 cm apart). (a, b) Acadian redfish, Outer Schoodic Ridge and Western Jordan Basin, respectively. (c, d) Atlantic cod, Western Jordan Basin. (e, f) Cusk, Outer Schoodic Ridge.

Figure 11. (continued) (g) Pollock, Outer Schoodic Ridge. (h) Juvenile silver hake, Outer Schoodic Ridge. (i) Spiny dogfish and cusk, Outer Schoodic Ridge. (j) Pollock, Atlantic herring and spiny dogfish, Outer Schoodic Ridge. (k) Goosefish, Western Jordan Basin; (l) Goosefish as in previous image unsuccessfully attacking a small silver hake (at arrow).

Figure 12. Specimen of *Anthothela grandiflora* at 214 m on Outer Schoodic Ridge (2014). A first report for this species in the Gulf of Maine.

Figure 13. Cushion stars *Hippasteria phrygiana* preying upon a fallen colony of *Primnoa reseadiformis* on Outer Schoodic Ridge (2014).

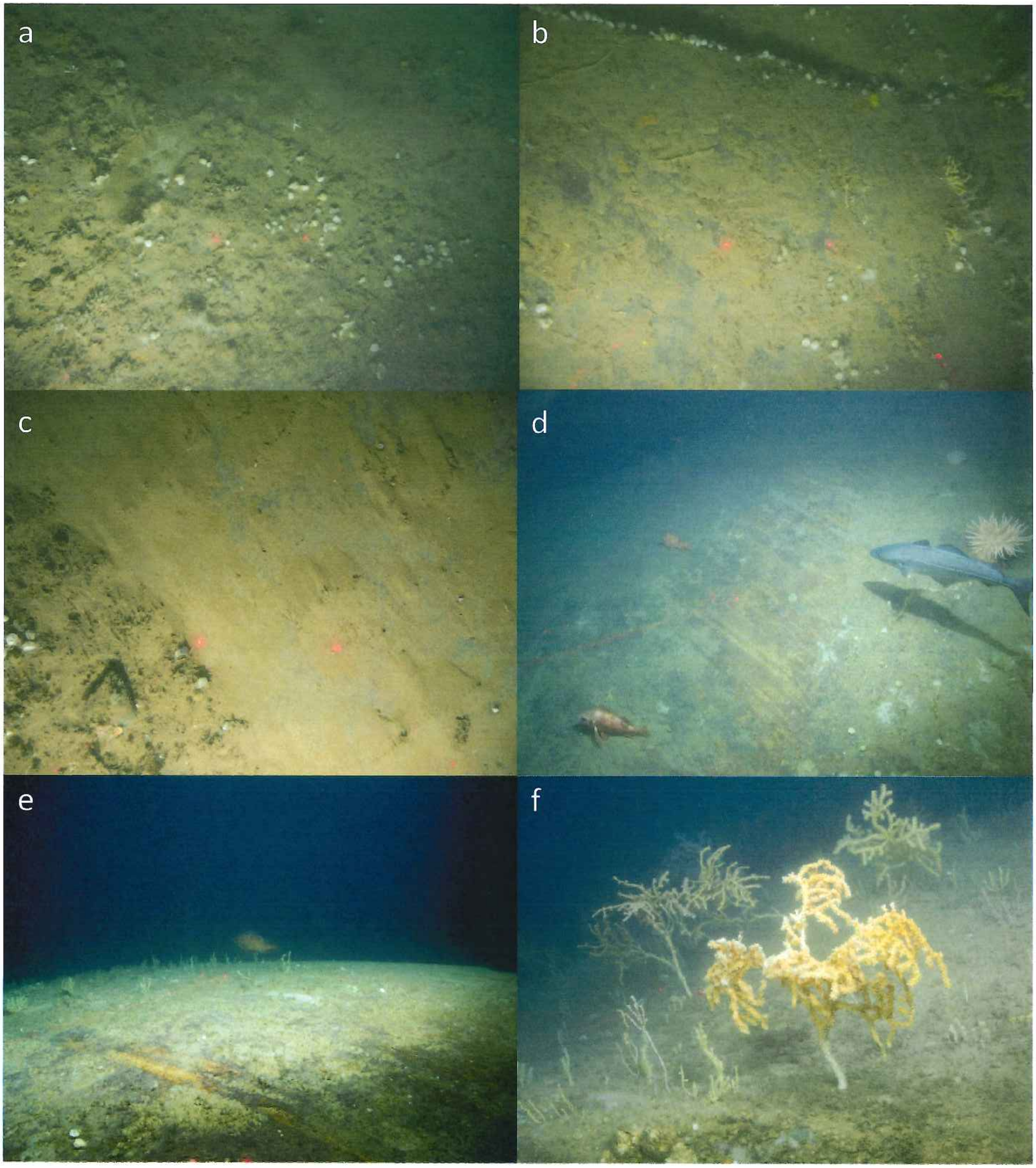


Figure 14. Examples of impacts to coral habitats. (a-c) Examples of impacts consistent with fixed gear from 2013 surveys (laser dots 20 cm apart), Western Jordan Basin. (d, e) Examples of mobile gear impacts to hard bottom from 2014 surveys (laser dots 10 cm apart), Central Jordan Basin site. (f) Example of sub-lethal damage to corals and subsequent recruitment resulting in disjunct size class structure, from 2014 surveys (laser dots 10 cm apart), Western Jordan Basin.