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Assessment of a Pilot Study to Collect Coral Bycatch Data from the Alaska Commercial Fishing Fleet

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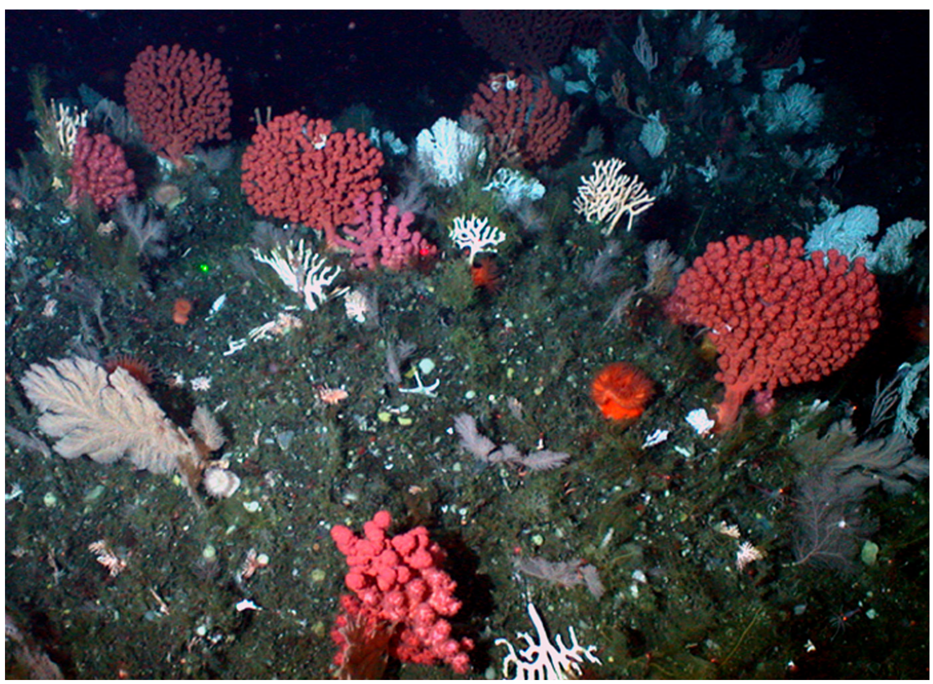

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Cover: Deep-sea coral habitat at 920 m depth on the southeast flank of a submarine volcano (Amchixtam Chaxsxii) in northern Amchitka Pass, central Aleutian Islands. Image courtesy of the West Coast and Polar Regions Center of NOAA's Undersea Research Center.

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ABSTRACT

The North Pacific Groundfish and Halibut Observer Program is a potentially huge source of coral location data that could provide much needed information on high diversity hotspots and vulnerable marine ecosystems. We implemented a pilot project in 2012 and 2013 with experienced fisheries observers to improve data collection on coral bycatch by the Alaskan commercial fishing fleet. Observers were provided with coral identification training in a classroom setting and taxonomic field guides and instructed to collect and identify each unique coral taxon encountered when possible. Specimens were frozen and shipped to the Alaska Fisheries Science Center where they were identified. Specimen identifications were used to gauge the potential capabilities and limitations of the observers and resolve problems with coral identification training and collection protocols. Over 240 observers received training during this project and they observed 20,945 gear hauls during the study period. Trained observers reported corals in less than 10% of sampled hauls, and more than 70% of reported corals were sea pens and sea whips (pennatulaceans). Samples collected by observers indicate that identification accuracy was relatively low, with 74% of corals correctly identified to the requested taxonomic level. Misidentified specimens included a variety of benthic invertebrates such as hydroids, bryozoans, and sponges. The highly variable success rate among observers and relatively low overall accuracy rate indicates that the level of training was insufficient to provide consistently reliable results at the requested level of taxonomy. Long-term implementation of a coral identification protocol, like the one tested for this project, would require a significant investment of training resources.

CONTENTS

INTRODUCTION

Deep-sea corals are widespread throughout Alaska, including the continental shelf and upper slope of the Gulf of Alaska, the Aleutian Islands, the eastern Bering Sea, and extend as far north as the Beaufort Sea (Stone and Shotwell 2007). Disturbance from fishing activities is presently the greatest threat to coral habitat in Alaska (Stone and Shotwell 2007). Spatial restrictions on the use of some fishing gears do exist in Alaska (Witherell and Woodby 2005) but many areas of known and suspected coral and sponge habitat remain open to potentially damaging bottom-tending gear. For example, much of the Aleutian Island Archipelago is closed to bottom trawling under the Aleutian Island Habitat Conservation Area regulations, but some areas of potential (and known) coral habitat are still at risk to disturbance from fishing activities (Stone 2014).

The Deep Sea Coral Research and Technology Program (DSCRTP) was established under Section 408 of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSA) of 2006 (Public Law 109-479). This project is specifically relevant to the MSA mandate to sustainably manage the Nation’s fisheries, including the need to assess fisheries bycatch and map essential fish habitats. Information on the distribution, abundance, and species diversity of coral bycatch by the fishing fleet may provide resource managers with the necessary information to improve conservation measures for coral habitats. Analysis of bycatch of epibenthic species, particularly corals, has been identified as an important tool in identifying benthic habitats vulnerable to disturbance from deep-sea fisheries (FAO 2009). Training programs in coral bycatch identification have been implemented in other regions (e.g., Parker et al. 2009, Tracey et al. 2011) and are becoming a standard tool worldwide to address mandates by the United Nations General Assembly Resolution on Sustainable Fisheries to address the potential effects of high seas fisheries on seafloor habitats. Alaska has a relatively high rate of coral bycatch in fisheries (NMFS 2004), therefore, improving the information base on this bycatch is potentially very important to resource managers. Additionally, improved taxonomic resolution of bycatch specimens could provide the detailed information necessary to identify the location of high diversity hotspots and vulnerable marine ecosystems (VMEs).

The Fisheries Monitoring and Analysis Division (FMA) at the Alaska Fisheries Science Center monitors groundfish fishing activities in the U.S. Exclusive Economic Zone off Alaska via the North Pacific Groundfish and Halibut Observer Program (hereafter referred to as the "Observer Program"). Over 300 observers are deployed on board the fishing fleet annually (390 in 2014), and the distribution of observers is broadly based on vessel size, gear type, and the fishery in which a particular vessel participates. Observers are deployed on vessels fishing with pelagic and non-pelagic (bottom) trawl gear as well as fixed gears (longlines and fish pots). Targeted species include walleye pollock (*Gadus chalcogrammus*), Pacific cod (*Gadus macrocephalus*), Atka mackerel (*Pleurogrammus monopterygius*), sablefish (*Anoplopoma fimbria*), rockfish (*Sebastes* spp.) and several species of flatfish (Pleuronectidae). Typical fishing depths depend on the target species and may range from < 20 m for trawl vessels targeting flatfish in the Bering Sea to 500 m or more for longline vessels targeting sablefish and Greenland turbot (*Reinhardtius hippoglossoides*). Observers provide catch data on both target and bycatch species to fisheries managers, stock assessment scientists, and other researchers. There is potential to collect a huge amount of valuable data on deep-sea corals given the broad geographical coverage of the fishing fleet in Alaska and the often coincidental distribution of many of these fisheries and deep-sea coral habitat.

The primary focus of the Observer Program is to collect data on commercially targeted finfish and crab species. The level of taxonomic resolution currently recorded by observers for corals and other non-target species is extremely limited. Of the 134 known taxa of corals in Alaska (R. Stone, unpublished data), the Observer Program provides identification training for only a single species, the red tree coral (*Primnoa pacifica*). All other corals are lumped into a single category ("coral, unidentified"), except for seapens and seawhips which are recorded as Order Pennatulacea. The National Marine Fisheries Service currently has little information regarding the coral taxa most frequently encountered by the fishing fleet or the species richness of coral bycatch. Without this information resource managers are less capable of fully assessing disturbance to sensitive seafloor habitats and informing management actions including the appropriate location of Habitat Areas of Particular Concern (HAPCs).

Although the broad scope and geographical coverage of the Observer Program make it a tempting platform for the collection of data on non-commercial species and associated ecosystem factors, observers are currently tasked with many requirements essential to agency programs. Observers collect a wide array of physical and biological data and samples, including otoliths and stomach contents. They are expected to quickly and efficiently identify to species all commercially important fishes and crabs, as well as identifying all non-commercial fishes to at least the taxonomic level of Family. Initial training of new observers requires 3 weeks and returning observers are required to complete one week of refresher training annually. Thus, the potential effects of adding new tasks to the suite already performed by observers must be carefully weighed, both in terms of training resources available and the ability of the observers to effectively perform their core duties. New training protocols must be developed and tested and a program to monitor the quality of new data must be implemented.

The goals of this project were to develop a training program and materials to enable observers to identify corals during deployment, to assess the time costs of this additional responsibility, and to assess the consistency and reliability of the identifications.

METHODS

Beginning in March 2012 a coral identification training presentation was given to returning observers as part of their pre-deployment information briefing. The training was provided only to experienced observers (i.e., those that had previously completed at least one deployment), and included a brief lecture on coral taxonomy and identification as well as the appropriate protocols for the collection and preservation of coral specimens. Training sessions were approximately one hour in length and were presented in the format of a Microsoft PowerPoint presentation with a detailed introduction to a "Field Guide to the Corals of the Aleutian Islands, North Pacific Ocean" (Appendix I). During the presentation, dried coral specimens representing those in the guide were made available for observers to examine. The field guide issued to trainees was developed specifically for this project and included simple descriptions and photos of 21 important taxa known to occur in the North Pacific Ocean and Bering Sea. The taxonomic resolution of the taxa was purposely chosen to test the range of observer ability while also providing useful zoogeographical information to researchers. The description for each taxon included information on general morphology as well as distinguishing or diagnostic characteristics.

Observers were asked to participate in this project as time permitted. They were instructed to use the guide to identify any coral specimens encountered during their deployment to the most specific taxonomic level possible and to label the specimen with their best identification. Observers were instructed to collect one specimen of each unique coral taxon encountered at each fishing station. Specimens were photographed (when possible), labeled and frozen, and then shipped to the Alaska Fisheries Science Center in Seattle, Washington, at the end of each fishing trip for expert identification and museum archiving. Specimens were identified by the authors, all of whom have much experience and skill identifying the subject specimens, using verified museum voucher specimens as comparisons. All data were incorporated into the NOAA-NMFS Observer Program database (NORPAC) and will be available to the DSCRTP for future analyses and mapping. Observers were given questionnaires to provide feedback about all aspects of the pilot project including the field guide, training sessions, and logistical concerns.

The “Field Guide to the Corals of the Aleutian Islands, North Pacific Ocean” included the following coral groups:

Order Anthoathecatae (hydrocorals). Hydrocorals are a diverse and structurally important group of corals in Alaska. They are most common in the Aleutian Islands and are a dominant component of the coral gardens there. They are also present in the Gulf of Alaska but rare in the Bering Sea. Observers were asked to identify five common taxa to genus or species.

Order Scleractinia (stony corals). All scleractinians in Alaska are small, solitary "cup" corals. Observers were asked to identify specimens to the taxonomic level of Order and to collect every specimen encountered. Cup corals are very small and extremely difficult to identify to higher taxonomic resolution so would be a valuable contribution to ongoing work on taxonomy and the zoogeography of these corals.

Order Gorgonacea (gorgonians). This is the most abundant and species rich group of corals in Alaska. Observers were asked to identify 12 taxa to genus or species.

Order Alcyonacea (true soft corals). The taxonomy of this group of corals is largely unknown. Observers were asked to identify to the taxonomic level of Order.

Order Antipatharia (black corals). Black corals are uncommon in Alaska but present in small patches at depths greater than 400 m. Observers were asked to identify only to the taxonomic level of Order.

Order Pennatulacea (sea pens and whips). Sea pens and sea whips are typically found on soft sediment areas where they may be abundant. Observers were asked to continue previous protocol for this group—identify to the taxonomic level of Order.

RESULTS

2012 Season

During the 2012 season (December 2011 – October 2012) 122 observers received the coral identification training. Fourteen separate briefing sessions were provided and class size ranged from 3 to 21 students. Observers who received the special training sampled 8,622 hauls (hereafter "hauls" refers to a set and retrieval of any gear type) and reported corals (excluding sea whips/pens) present in 371 (4.3%) of those hauls (Table 1). Feedback questionnaires were received from 22 observers (18% of the total); 12 had encountered corals during their deployment and 10 had not encountered corals during their deployment. Overall, the feedback received from observers was generally positive. Most respondents felt that the guide and training were adequate and that identifying the few corals encountered did not consume much time.

A total of 71 specimens were collected by 8 different observers during the 2012 season (Appendix II). Of those, 34 specimens included taxonomic information as requested. The remaining specimens were identified only to “coral unidentified” or to higher taxonomic levels (e.g., Primnoidae). Observers correctly identified 64% of the specimens. Of the specimens that were misidentified, 77% were identified as corals but not the correct coral. An additional 23% of the misidentified specimens were actually sponges, bryozoans, and hydroids.

2013 Season

A few changes were made to the program prior to the 2013 season based on observer feedback. The field guide was streamlined by eliminating some of the non-critical descriptive information and we combined some of the more difficult taxa (e.g., those with similar morphology). Observers were also provided with specimen log sheets to help track identifications. During the 2013 training season (December 2012 – October 2013) 182 observers received the coral identification training, including 62 returning observers who had been trained in 2012. Ten separate briefing sessions were provided. Observers sampled 12,323 hauls and reported corals (excluding sea whips/pens) in 148 hauls (1.2%; Table 1). Feedback questionnaires were received from 17 observers (9.3% of the total); 15 had encountered corals during their deployment and 2 had not encountered corals during their deployment. Observer feedback for 2013 was generally positive and most observers reported little difficulty identifying the more distinctive species (e.g., *Paragorgia arborea*). The most common suggestions from observers included restructuring the guide as a dichotomous key and integrating the project more seamlessly with other observer duties (e.g., adding species codes and distributing the coral guide as a package with other identification guides).

A total of 117 specimens were collected by 28 observers during the 2013 season (Appendix II). Of those, 83 specimens included taxonomic information as requested and the others were recorded as “coral unidentified” or to higher taxonomic levels (e.g., Primnoidae, hydrocoral, gorgonian). Observers correctly identified 66% of the 83 specimens. Of the specimens that were misidentified, 52% were identified as corals but not the correct corals, and 48% of the misidentified specimens were actually sponges, bryozoans, hydroids, and macroalgae.

Both Seasons

In general, corals were rarely encountered in the fisheries and observers reported corals in less than 10% of sampled hauls. Over 70% of the corals reported were pennatulaceans and they were reported on 6.4% of all hauls. The general geographic pattern of observed fishing effort and coral encounters was similar during both years with considerably more effort concentrated in areas of the Bering Sea (Table 2; Fig. 1). Pennatulaceans were most common in the Bering Sea (NMFS areas 521 and 523; Table 2), while all other corals were most common in the Aleutian Islands (NMFS areas 541–543; Table 3). Most of the corals reported by observers (63.9%) were encountered on longline gear, even though longlines accounted for only 26% of the sampled hauls (Table 1). Pelagic trawls and bottom trawls (22.6% and 48.2% of observed hauls, respectively) each accounted for about 18% of coral records (Table 1). Only a few coral encounters were reported with pot gear (Table 1).

Observers correctly identified 74% of the collected specimens (Table 4). They were accurate at identifying some taxa (e.g., *Paragorgia arborea* and *Muriceides nigra*) while others (e.g., *Plumarella* spp./*Thouarella* spp. and *Arthrogorgia* spp.) were more problematic (Table 4). Observers were generally accurate at identifying alcyonaceans to Order (Alcyonacea), as 82% of collected specimens were correctly identified at that level (Table 4). For the gorgonians (Order Gorgonacea), some generic and species-level identifications were problematic, but observers correctly identified 98% of specimens (92 of 94) to the Order Gorgoncea. Only four hydrocoral specimens were collected during the project, and the only one that was identified beyond "coral unidentified" was identified correctly (*Stylaster* sp.). No scleractinians or anitipatharians were collected (Table 4). Observers were instructed not to collect pennatulaceans, as we assumed that they are distinctive enough to be accurately identified nearly 100% of the time.

Observers collected 29 specimens that were not corals (Appendix II). The most common errors were that hydroids were often mistaken for black corals and sponges were mistaken for hydrocorals (Fig. 2). There was also a marked difference in the ability of the observers to identify the corals. Identification success rates varied from only 43% to 100% for those observers who collected more than five specimens (N = 10) and routinely attempted to identify specimens beyond the taxonomic level of “coral unidentified”.

A total of 54 observers completed project questionnaires at the end of their cruises (Appendix III). Only 74% of respondents (40 of 54) encountered corals while at sea. Respondents reported coral encounters in all major regions (50% in Bering Sea, 32% in Aleutians, 28% in Gulf of Alaska), using the three main gear types (55% bottom trawl, 30% longline, 15% pelagic trawl), and in a number of target fisheries (Atka mackerel, Pacific cod, flatfish, walleye pollock). Over 50% of respondents reported spending 5 minutes or less per specimen to identify corals, and another 20% reported spending less than 10 minutes per specimen. Respondents generally thought the field guide worked well, with 80% reporting that the guide was adequate and only 8% of respondents stating that the guide was inadequate in its current form. Suggestions for improving the field guide included adding more high-resolution or close-up photos (12 respondents), adding more geographic or bathymetric distribution data (4 respondents), and reorganizing the guide as a dichotomous key (3 respondents). Suggestions for improving the coral training presentation included adding more training time (2 respondents), clarifying project expectations (2 respondents), improving the quality of the demonstration specimens, and focusing more on common taxa. Relatively few respondents listed any additional comments about the project, but those that did stated either that the demonstration specimens were the most important part of the training (2 respondents) or that more training time was needed (2 respondents).

DISCUSSION

This project represents an important first step toward improving the quality of coral bycatch data collected on commercial fishing vessels in Alaska. The training program and field materials developed for this project were well received by observers and most trainees were comfortable identifying corals after the training sessions. Most of the trainees that provided feedback regarding the time commitment required for coral identification indicated that they did not encounter large numbers of corals, and that the identification process was not particularly time consuming. Thus, although the training of observers to the taxonomic level specified for this study does require significant time and resources, the actual performance of the field identifications does not appear to be particularly time intensive.

Unfortunately, the time and resources expended in the training of observers did not result in consistently accurate field identifications, as nearly 40% of collected specimens were misidentified at some level. Corals are inherently difficult to identify, as many of the diagnostic characters separating taxa are difficult to resolve in the field, and to the untrained eye (or lightly trained eye) the variation within a taxon (e.g., coloration, branching pattern, polyp characteristics) can often appear greater than the variation distinguishing the taxa from each other. In addition to the difficulty in distinguishing one coral taxon from another, this study clearly demonstrates that corals can be difficult to distinguish from other sedentary invertebrates, such as sponges and bryozoans. This was not a completely unexpected result. We purposely excluded other sedentary invertebrates from the training in an effort to minimize confusion of these taxa with corals. However, we now conclude that future training of observers in coral identification should include examples of other sedentary invertebrates to show distinguishing characteristics between the groups. Field guides including non-coral taxa have been constructed in other regions, such as the region of the Southern Ocean (CCAMLR region or Commission for the Conservation of Antarctic Marine Living Resources region), and have apparently been well received by users (CCAMLR 2009). In 2010, fisheries observers in Ross Sea fisheries identified 88% of 4,555 specimens accurately using such a guide (Steve Parker, The National Institute of Water and Atmospheric Research, New Zealand, personal communication) and similar to our results, most incorrect identifications were cases of confusing groups that were very similar in morphological appearance.

Observers encountered, or at least reported, corals infrequently during this study and despite the relatively low accuracy of coral identifications some general zoogeographic trends were clearly apparent from the data. For example, pennatulaceans were the most common corals encountered in Bering Sea fisheries where the seafloor typically consists of soft sediment with relatively little slope and roughness. Conversely, a much more diverse suite of corals was encountered in Aleutian Islands fisheries where the seafloor is more variable in terms of substrate and bathymetry. Surprisingly, bottom trawlers accounted for less than 20% of the corals reported, despite representing almost half of the observed hauls. Thus, while pelagic trawls and fixed gear types (e.g., longlines and pots) are generally considered to have less of an interaction with seafloor habitats (Stone and Shotwell 2007), they are potentially valuable sources of information on coral diversity and distribution.

Our primary project goal was to obtain adequate information to confidently assess the costs and benefits of a routine coral identification program within the Observer Program. The current program would need to be substantially modified to train observers to consistently and accurately identify corals to taxonomic levels finer than about Order. While Order-level data provide some useful information regarding abundance and the location of coral habitats they provide little information regarding species richness and diversity—two important metrics with which to potentially gauge the value of coral habitats. The results of this project indicate that there would be unfunded costs with such a program principally in the form of instructor time. The training effort provided to observers in this study (approximately one hour during each 4-day briefing session) is not likely sustainable long term given the primary training needs of the program.

The accuracy level of coral identifications demonstrated by observers in this project indicates that the level of training provided may not have been adequate. The factors influencing the variable success rates shown here are likely numerous, complex, and confounded. Observer trainees enter the program with highly varied backgrounds that do not necessarily include familiarity with marine invertebrates and the time constraints and working conditions under which observers operate are highly variable and often extreme. Feedback responses indicated that the field time required to complete coral identifications is generally minimal, and that coral encounters are relatively rare, so adding coral identification to the list of observer responsibilities would probably not detract significantly from other priorities in the field. However, if the program cannot devote enough training resources to ensure consistently accurate identifications of corals over the long term, then the limited benefits of unreliable data will not justify any significant changes in the current policy.

This 2-year pilot project was funded by NOAA's DSCRTP. There is no committed source of funds or adequate staffing available to continue the training of observers or the tracking of coral identifications at the level of this project. Accordingly, the level of training provided as part of this project was discontinued and beginning in 2014 observers were provided with a simple tutorial (Appendix IV) and asked to review it outside of class time. The tutorial is essentially a simple guide and observers are currently being asked to identify corals to the level of Order. This is a minor improvement to the protocol that was in place prior to this project, and its efficacy will be monitored and reevaluated in the coming years. Reevaluation of this protocol in a few years may indicate that working with a small but highly skilled subset of observers, as indicated in this study, may provide a means to gather additional accurate data at higher taxonomic resolution.

The fishing fleet continues to be a largely untapped and potentially very important source of coral location data in Alaska. However, expanding the level of training and identification monitoring much beyond the current level of the Observer Program is limited by funding. Until this limitation is resolved, and/or program priorities are significantly altered (e.g., by changes to the language of the MSA), the collection of these valuable data will occur only at an opportunistic level.

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Table 1. -- Observer sampling effort (hauls) and encounter rates (% of total hauls) for sea pens and all other corals for each gear type during the 2012 and 2013 project years. Refer to Figure 1 for the geographical location of the management areas in Alaska.

Gear type	Bottom trawl	Pelagic trawl	Pot	Longline	Total
Hauls 2012	4,890	1,071	343	2,318	8,622
% (sea pens)	0.4	3.5	0.3	14.0	4.5
% (corals)	4.1	0	0	7.3	4.3
Hauls 2013	5,207	3,658	292	3,166	12,323
% (sea pens)	0.4	7.9	0	18.4	7.2
% (corals)	1.4	0.2	0.7	2.2	1.2

Table 2. -- Observer sampling effort (hauls) and encounter rates (% of total hauls) for sea pens and all other corals in the Bering Sea during the 2012 and 2013 project years. Refer to Figure 1 for the geographical location of the management areas in Alaska.

Area	509	512	513	514	516	517	518	519	521	523	524	Total
Hauls 2012	1,694	65	1,052	955	255	861	26	273	1,155	66	314	6,716
% (sea pens)	1.2	0	1.3	0	0	7.7	0	0.7	20.4	30.3	4.1	5.5
% (corals)	0.8	0	1.2	0.2	0	0.8	7.7	0.7	3.4	0	0.3	0.7
Hauls 2013	3,618	0	1,810	154	263	2,753	0	63	2,421	86	11	11,179
% (sea pens)	5.6	–	2.9	0	0	5.8	–	0	16.1	58.1	0	7.6
% (corals)	0.9	–	0.3	0	0	0.4	–	3.2	1.3	0	0	0.7

Table 3. -- Observer sampling effort (hauls) and encounter rates (% of total hauls) for sea pens and all other corals in the Aleutian Islands (Areas 541, 542, and 543) and the Gulf of Alaska (Areas 610, 620, 630, 640, 649 and 650) during the 2012 and 2013 project years. Refer to Figure 1 for the geographical location of the management areas in Alaska.

Area	541	542	543	Total	610	620	630	640	649	650	Total
Hauls 2012	385	257	99	741	142	245	648	88	0	42	1,165
% (sea pens)	0	0	0	0	5.6	0.4	0.3	0	–	2.4	1.0
% (corals)	41.8	19.8	36.4	33.5	7.7	2.9	1.9	12.5	–	4.8	3.7
Hauls 2013	323	30	11	364	266	164	320	2	6	22	780
% (sea pens)	0	0	0	0	10.9	0.6	2.8	0	0	0	5.0
% (corals)	15.5	16.7	18.2	15.7	1.5	1.8	0.6	0	0	0	1.2

Table 4. -- Identification accuracy for all specimens collected by observers for this study, broken down by the 21 specific taxonomic groupings included in the training and field guide. Observers were tasked with identifying corals in the field to 21 specific taxonomic groupings. A total of 160 corals were collected by observers and identifications were provided for 106 specimens. Seventy-four percent (79 of 106) of the specimens were identified correctly.

Taxon	Number	% ID correct
Order Anthoathecatae (hydrocorals)		
Crypthelia trophostega	0	–
Cyclohelia lamellata	0	–
Distichopora borealis	0	–
Errinopora spp.	0	–
Stylaster spp.	1	100
Order Scleractinia (stony corals)	0	–
Order Gorgonacea (gorgonians)		
Alaskagorgia aleutiana	2	100
Cryogorgia koolsae	2	50
Muriceides nigra	13	85
Swiftia pacifica	1	100
Calcigorgia sp.	6	33
Paragorgia arborea	14	93
Plumarella spp./*Thourella* spp.	30	73
Arthrogorgia spp.	8	38
Fanellia spp.	11	82
Parastenella spp.	0	–
Primnoa spp.	7	71
Isidella spp./*Keratoisis* spp.	0	–
Order Alcyonacea (true soft corals)	11	82
Order Antipatharia (black corals)	0	–
Order Pennatulacea (sea pens and whips)	0	–
All corals	106	74

Figure 1. -- Map of North Pacific Ocean and Alaska showing NMFS statistical management areas and the geographic distribution of observed hauls (shaded area) summarized for this project. Areas 508, 530, and 550 in the Bering Sea had no observed hauls.

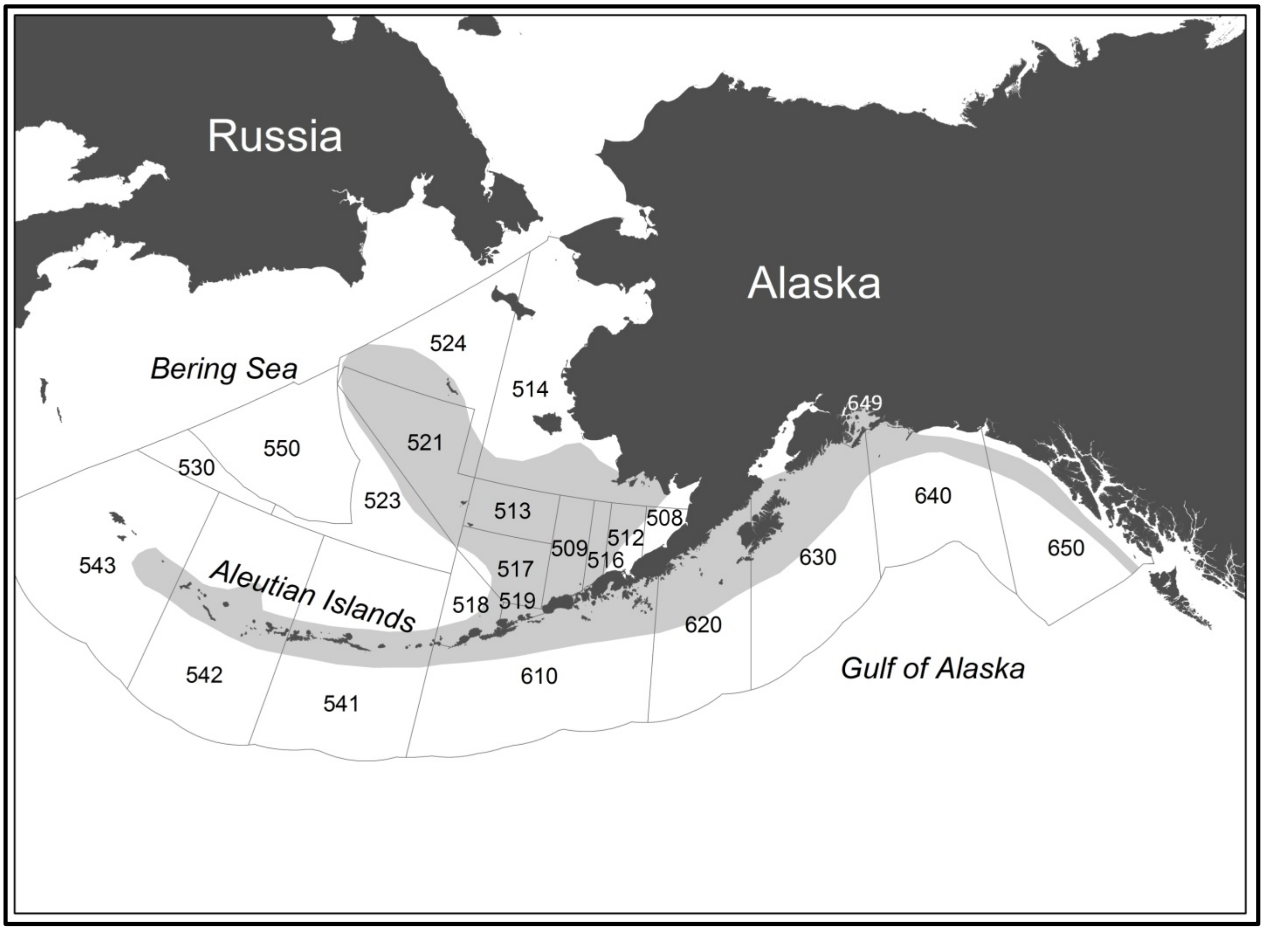
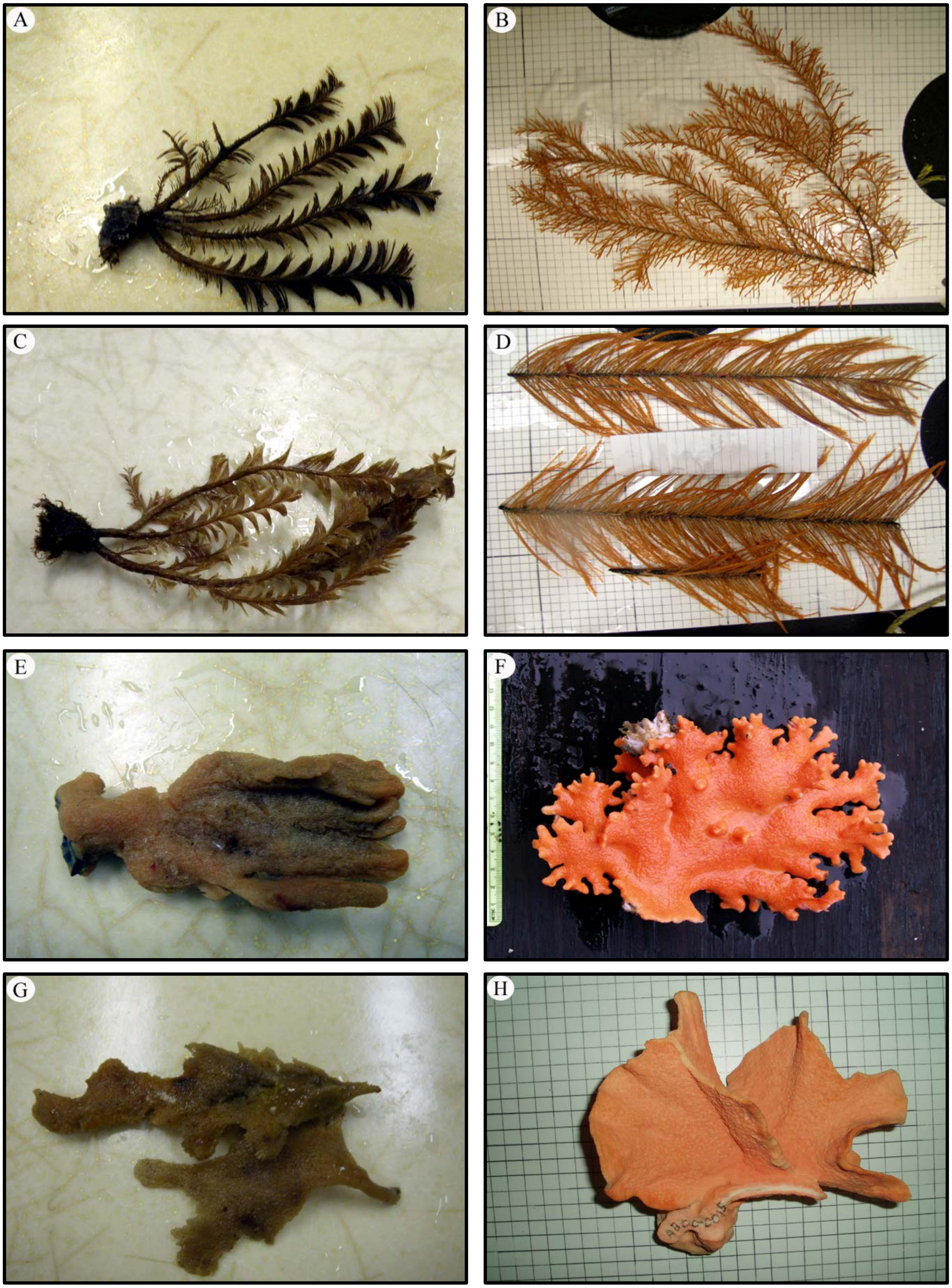


Figure 2. -- Examples of fauna that, based on the identifications made by observers, were easily confused with corals. A plumose hydroid (A) that was identified as a black coral and possibly confused with a black coral *Dendrobathypathes boutillieri* (B), a plumose hydroid (C) that was identified as a black coral and possibly confused with the black coral *Parantipathes* sp. (D), a demosponge (E) that was identified as the hydrocoral *Errinopora* sp. (F), and a demosponge (G) that was identified as the hydrocoral *Cyclohelia lamellata* (H). (See following page).

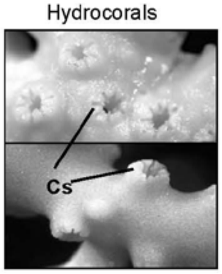

A
B
C
D
E
F
G
H

Appendix I. -- Field guide to the corals of the Aleutian Islands, North Pacific Ocean provided to observers for use in this study.

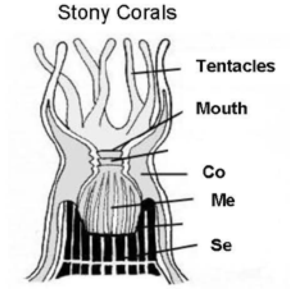
Field Guide to the Corals of the Aleutian Islands, North Pacific Ocean

This field guide provides fisheries and scientific observers with the ability to identify the common coral fauna that may be collected during bottom trawl fisheries in the Aleutian Islands. The guide includes the six major taxonomic groups of deep-sea corals commonly encountered as bycatch in the central Aleutian Islands: Anthoathecatae (hydrocorals), Scleractinia (stony corals), Antipatharia (black corals), Gorgonacea (gorgonians), Alcyonacea (true soft corals), Pennatulacea (sea pens and sea whips). Brief descriptions of representative corals from the six major groups are provided, along with photographs of the corals. Distinguishing characters for all taxa are highlighted in bold.

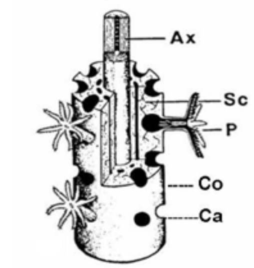
Hydrocorals



Stony Corals



Gorgonians



Glossary of terms:

- Calcareous: composed of or containing calcium carbonate
- Polyp (**P**): an individual of a coral colony; cylindrical trunk with mouth surrounded by tentacles
- Calyx (calyces) (**Ca**): a cuplike structure containing a polyp (these are called zooids in hydrocorals – see below)
- Coenenchyme (**Co**): the soft tissue covering the skeleton exclusive of the polyps
- Colonial: consisting of a group of polyps rather than an individual
- Retractile: polyps retract into the calyx. Non-retractile polyps remain outside the calyx and appear 'droopy'
- Colony characteristics: **Digitate** = finger-like, **Flabellate** = fan shaped, **Pinnate** = feather-like, **Uniplana**r = flat, **Dichotomous** = divided into two.

Hydrocorals

- Cyclosystem (**Cs**): arrangement of gastropore and dactylopores on the surface of the skeleton

Stony corals

- Mesenteries (**Me**): finger-like projections that make up the lower part of the polyp, and which are embedded in the skeleton
- Septae (**Se**): skeletal divisions within the calyx that mark divisions between the polyp mesenteries

Gorgonians

- Axial skeleton (**Ax**): bone or whip-like structure in center of colony
- Sclerites (**Sc**): small needlelike, calcareous structures embedded in the tissue

Prepared by Robert Stone (NOAA Fisheries, Alaska Fisheries Science Center), Sandra Brooke (Marine Conservation Institute) and Duane Stevenson (NOAA Fisheries, Alaska Fisheries Science Center). Images courtesy of NOAA Fisheries, National Museum of Natural History (Smithsonian Institution), and Greenpeace.

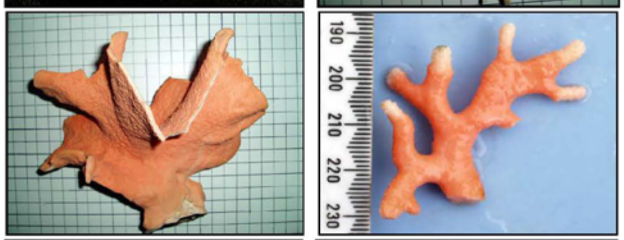
1

Anthoathecatae (hydrocorals)

All hydrocorals are colonial with a **hard inflexible calcareous skeleton**. Hydrocorals have v**ery small polyps embedded in skeletal pores** (gastro- and dactylopores, which create the cyclosystem). Colonies may be up to one meter tall and width but are often highly fragmented on deck as they are extremely fragile. Colonies are typically upright, and may be uniplanar (flat), bushy or variably branched with lamellar (flat blades), flabellate (fan-shaped) or digitate (finger-like) branches. Dead specimens are usually bleached. **Gridlines on all photos are 1 cm².**

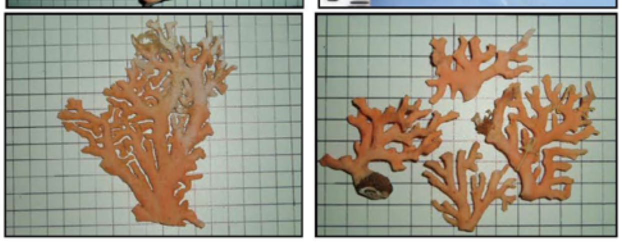
Crypthelia trophostega

This is the **only hydrocoral with prominent cap-like fixed lids that protect each pore and cyclosystem**. Colonies are uniplanar, very delicate and white to creamy white in color. Cyclosystems are typically arranged on one side of the colony only.



Cyclohelia lamellata

Typically lamellar with broad blades but occasionally digitate. Cyclosystems are very small and rather uniformly distributed on the surface. Color is orange or pinkish orange and often white along the margins. Digitate forms have white branch tips.



Distichopora borealis

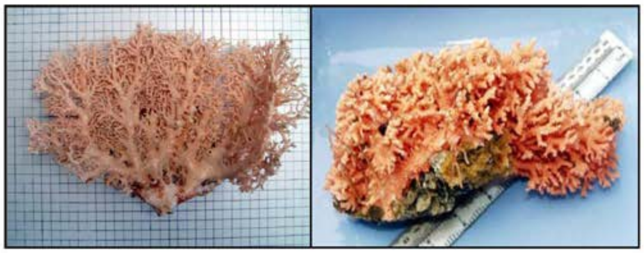
Uniplanar or somewhat flabellate and very delicate. **Pores mostly restricted to well-defined rows along branch margins**; other surfaces almost smooth. Color is light orange to orange.

2

Anthoathecatae (hydrocorals) - continued

***Errinopora* spp.**

Colonies are variable in shape but **typically uni-planar or bushy with non-connecting branches**. Branches often have blunt tips. Cyclosystems are very small and distributed in rows on the surface of the skeleton. Color is orange or pink



***Stylaster* spp.**

Colonies are bushy and highly branched, often with interconnected branches with very fine branch tips. **Cyclosystems are raised above the surface of the skeleton** and may be arranged on all surfaces. Colonies may be up to one meter tall and width but are often highly fragmented on deck as they are extremely fragile. Color is orange, pinkish orange, or pink.

Scleractinia (stony corals)

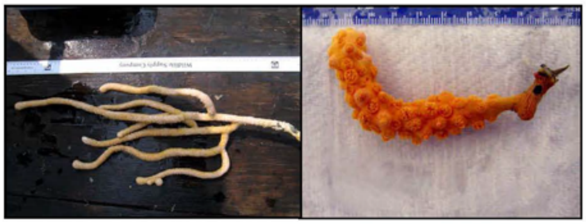
All stony corals in Alaska are small 'cup' corals with a hard calcareous skeleton. Polyps are embedded in a calyx (or cup) with septae arranged in a radial pattern. Specimens are fragile and collected specimens may be fragmented. Live specimens have soft tissue in the calyx that produces mucus when stressed. Dead specimens are often bleached in color and may be encrusted with sand and other organisms (tube worms etc.). Calyx color is white, light pink or light brown.

3

Gorgonacea (gorgonians)

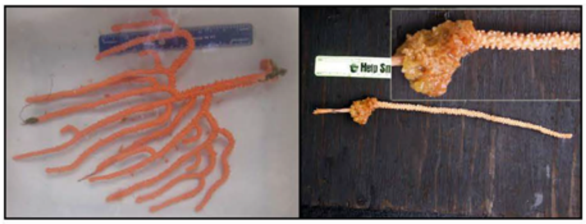
Gorgonians are colonial and may be bushy or uniplanar and quite large (more than 1 m tall). On deck, specimens resemble small trees, fans, or bushes. Internal skeleton is firm but flexible and may be 'woody' (dark protein material) or calcified (white bone-like). Healthy colonies always have tissue covering the skeleton whereas dead specimens have exposed skeletons. Polyps are generally small, and most are retractile, with a few exceptions.

Family Plexauridae



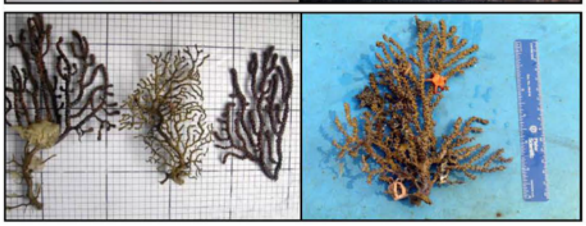
Alaskagorgia aleutiana

Stout, upright colonies **up to 1 m tall**. Laterally branched, **with thick club-like branches**. Large polyps retract into oval calyces with eight notches around the polyp. The axial skeleton is brown to dark brown and "woody"; never calcified. Color is orange, yellow or pale yellow.



Cryogorgia koolsae

Upright colonies up to 50 cm tall, are similar to but much less robust than *A. aleutiana*. Laterally branched with club-like branches. Large polyps partially retract. Axial skeleton is brown to dark brown and "woody". Color is orange to light orange.

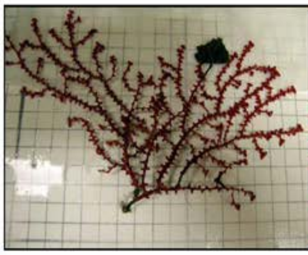


Muriceides nigra

Colonies up to 30 cm tall. Generally uniplanar and flabellate with a short stem. Many lateral branches that may again divide. Polyps partially retract into calyces that cover all surfaces. The skeleton is green to dark brown and "woody". **Color is olive green, bluish-purple**.

4

Gorgonacea (gorgonians) - continued




Family Plexauridae continued...

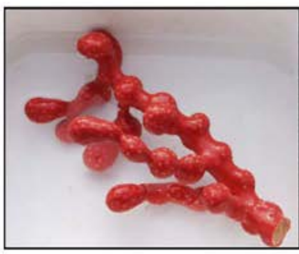
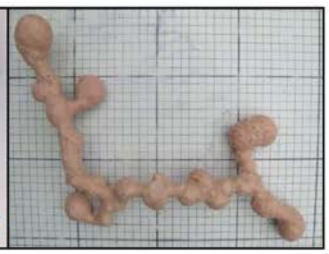
Swiftia pacifica

Colonies up to 25 cm tall are flexible, thin and uniplanar. Laterally branched, generally irregular. Small polyps partially retract into large round calyces that cover all surfaces. Axial skeleton is dark brown to black and 'woody' not calcified. **Color is vivid red or cranberry**


Family Acanthogorgiidae

Calcigorgia sp

Colonies up to 50 cm tall are flexible (more stout than *S. pacifica*), upright and uniplanar colonies. Laterally branched and irregular. Small polyps retract into circular calyces that cover all surfaces; more prominent on lateral edges. Axial skeleton is brown to dark brown and "woody". Color is light orange to flesh-colored.

Family Paragorgiidae

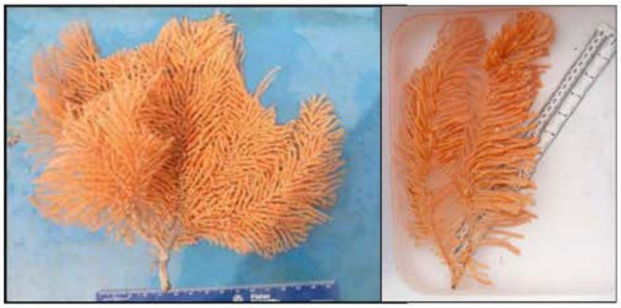
Paragorgia arborea **(bubblegum corals)**

Large (up to 2m tall) upright tree-like colonies are stout but easily broken. Laterally branched with **bubble-like concentrations of calyces** at regular intervals and particularly at terminal ends of branches. Large polyps are completely retractile into the nodules. **No axial skeleton.** Color is red, pink, white, orange or yellow.

5

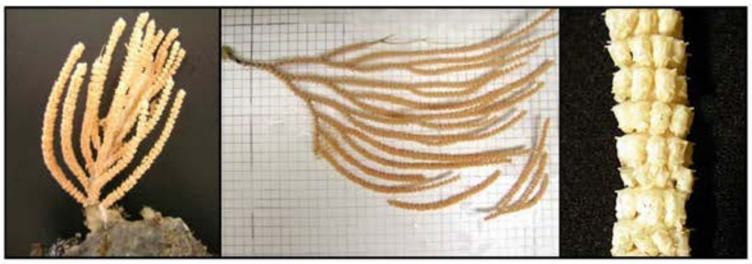
Gorgonacea (gorgonians) - continued

Family Primnoidae



Plumarella and Thouarella spp.

Colonies up to 75 cm tall are stout, flexible and upright. *Plumarella sp.* are typically uniplanar, but *Thouarella* resemble 'bottlebrushes'. Colonies have few main branches from which many smaller branches originate in an alternating manner. Small polyps are heavily scaled, alternately arranged on branches or crowded on all sides. Axial skeleton is pale yellow to dark brown and woody. Color is orange, light orange, and occasionally white.



Arthrogorgia spp.

Upright colonies up to 50 cm tall are stout and inflexible. Uniplanar with dichotomous or pinnate branching. **Polyps point downward and occur in close-spaced whorls with prominent spines**. Axial skeleton is brown and woody. Color is light orange to white.

Fanellia spp.

Upright colonies up to 1 m tall are stout but flexible. Uniplanar with dichotomous or pinnate branching. **Polyps point upward and occur in close-spaced whorls on all surfaces**. Axial skeleton is brown to bronze and woody. Color is orange.

6

Gorgonacea (gorgonians) - continued

Family Primnoidae - continued

Parastenella **spp.**

Colonies up to 30 cm tall are bushy or flabellate; slightly stiff but slender. Dichotomous or irregular branching. Delicate polyps arranged as whorls, pairs, or individuals. Axial skeleton is usually dark brown, "woody", and **usually visible under the thin tissue**. Color is light orange to white.

Primnoa **sp. (red tree corals)**

Large colonies up to 2 m tall. Often uniplanar but occasionally bushy. **Large fleshy polyps are heavily scaled, closely spaced, and typically face downwards**. Axial skeleton is golden, dark brown to black and usually appears "woody" but is often heavily calcified in larger individuals. Color is dark to light orange, and very rarely white.

Family Isididae

Isidella **and** ***Keratoisis*** **spp. (bamboo corals)**

Colonies up to one meter tall are stout and flexible, but fragile. **Skeleton composed of alternating long calcareous (white) and short proteinaceous (black) segments (nodes).** Colonies are typically uniplanar with large, 'droopy' (non-retractile) and tightly spaced polyps. Color is orange to golden orange

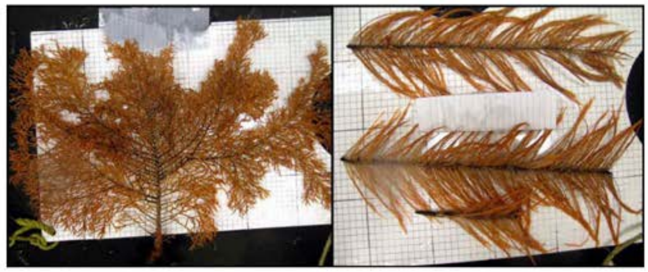
7

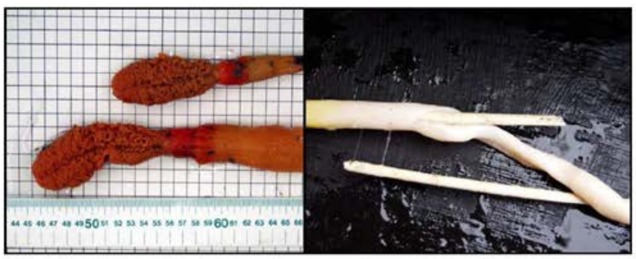
Alcyonacea (true soft corals)

Colonies have variably shaped fleshy bodies without an axial skeleton. Polyps are mostly retractile, but not always. Often attached to pebbles, sediment or other corals. **On deck, specimens resemble mushrooms or berries**. Color is highly variable and may be red, pink, brown, purple, orange or cream colored.

Antipatharia (black corals)

These are all colonial. **Axial skeleton is black or dark brown**, highly flexible and covered with small thorn-like projections. Live specimens are covered with a **mucus-rich** soft tissue with small non-retractable polyps. On deck, specimens generally resemble small trees, fans, bushes, or whips. Colonies are often attached to small cobbles, pebbles, or pieces of mudstone.





Pennatulacea (sea pens and whips)

Colonies consist of an **elongated fleshy stalk supported by a calcium carbonate rod.** The upper part of the stalk supports rows of polyps or branches with polyps; the lower part is an enlarged fleshy peduncle without polyps. Sea pens live in soft sediment. Sometimes only the calcium carbonate rod is brought up in a trawl net.

8

Appendix II. -- Identifications of specimens collected aboard fishing vessels during the 2012 and 2013 study. Observer IDs in **BOLD** are correctly identified specimens.

Observer No.	Specimen No.	Year	Observer ID	Correct ID
1	1	2012	***Plumarella* sp.**	*Thouarella* sp.
1	2	2012	*Primnoa* sp.	*Calcigorgia beringi*
1	3	2012	***Fanellia* sp.**	*Fanellia* sp.
1	4	2012	*Muriceides nigra*	Hydroid
1	5	2012	***Thouarella trilineata***	*Plumarella superba*
2	1	2012	**Alcyonacea**	Alcyonacea (*Gersemia* sp.)
3	1	2012	**Alcyonacea**	Alcyonacea (*Anthomastus* sp.)
3	2	2012	***Arthrogorgia* sp.**	*Arthrogorgia* sp.
3	3	2012	***Plumarella* sp.**	*Plumarella* sp.
3	4	2012	*Parastenella* sp.	*Calcigorgia* sp.
3	5	2012	***Thouarella* sp.**	*Thouarella* sp.
3	6	2012	Primnoidae	*Arthrogorgia* sp.
3	7	2012	*Fanellia* sp.	*Arthrogorgia* sp.
3	8	2012	*Crypthelia trophostega*	*Muriceides* sp.
3	9	2012	***Paragorgia* sp.**	*Paragorgia arborea*
4	1	2012	***Plumarella* sp.**	*Plumarella* sp.
4	2	2012	***Thouarella* sp.**	*Thouarella* sp.
4	3	2012	*Calcigorgia beringi*	*Muriceides nigra*
4	4	2012	Antipatharia	Hydroid
4	5	2012	*Parastenella* sp.	*Plumarella superba*
4	6	2012	**Alcyonacea**	Alcyonacea (*Anthomastus* sp.)
4	7	2012	***Arthrogorgia* sp.**	*Arthrogorgia* sp.
4	8	2012	***Alaskagorgia aleutiana***	*Alaskagorgia aleutiana*
4	9	2012	***Fanellia* sp.**	*Fanellia* sp.
4	10	2012	***Muriceides nigra***	*Muriceides nigra*
5	1	2012	***Paragorgia* sp.**	*Paragorgia arborea*
5	2	2012	Coral (unidentified)	*Calcigorgia* sp.
5	3	2012	Coral (unidentified)	*Fanellia* sp.
5	4	2012	Coral (unidentified)	*Arthrogorgia* sp.
5	5	2012	Coral (unidentified)	*Paragorgia arborea*
5	6	2012	Coral (unidentified)	Alcyonacea (*Anthomastus* sp.)
5	7	2012	Coral (unidentified)	*Plumarella* sp.
5	8	2012	Coral (unidentified)	*Cryogorgia koolsae*
5	9	2012	Coral (unidentified)	*Alaskagorgia aleutiana*
5	10	2012	Coral (unidentified)	Demospongiae
5	11	2012	Coral (unidentified)	*Plumarella* sp.
5	12	2012	Coral (unidentified)	*Fanellia* sp.
5	13	2012	Coral (unidentified)	*Plumarella superba*
5	14	2012	Coral (unidentified)	*Plumarella* sp.
5	15	2012	Coral (unidentified)	*Muriceides nigra*
5	16	2012	Coral (unidentified)	*Plumarella* sp.

5	17	2012	Coral (unidentified)	*Cryogorgia koolsae*
5	18	2012	Coral (unidentified)	*Plumarella superba*
5	19	2012	Coral (unidentified)	*Plumarella superba*
5	20	2012	Coral (unidentified)	*Thouarella* sp.
5	21	2012	Coral (unidentified)	*Crypgorgia koolsae*
5	22	2012	Coral (unidentified)	*Plumarella superba*
5	23	2012	Coral (unidentified)	*Plumarella* sp.
5	24	2012	Coral (unidentified)	*Plumarella* sp.
5	25	2012	Coral (unidentified)	*Muriceides nigra*
5	26	2012	Coral (unidentified)	*Muriceides* sp.
5	27	2012	Coral (unidentified)	*Plumarella* sp.
5	28	2012	Coral (unidentified)	*Fanellia* sp.
5	29	2012	Coral (unidentified)	*Plumarella* sp.
5	30	2012	Coral (unidentified)	*Plumarella* sp.
5	31	2012	Coral (unidentified)	*Calcigorgia beringi*
5	32	2012	Coral (unidentified)	*Cryogorgia koolsae*
5	33	2012	Coral (unidentified)	*Muriceides nigra*
5	34	2012	Coral (unidentified)	Alcyonacea (*Anthomastus* sp.)
6	1	2012	*Fanellia* sp.	*Arthrogorgia* sp.
6	2	2012	*Calcigorgia* sp.	*Arthrogorgia* sp.
6	3	2012	***Plumarella* sp.**	*Thouarella* sp.
6	4	2012	**Alcyonacea**	Alcyonacea (*Anthomastus* sp.)
6	5	2012	*Cryogorgia koolsae*	*Plumarella* sp.
6	6	2012	***Calcigorgia spiculifera***	*Calcigorgia spiculifera*
7	1	2012	Coral (unidentified)	Gastropod eggs
7	2	2012	Primnoidae	Demospongiae (skeleton)
7	3	2012	Coral (unidentified)	Bryozoan
7	4	2012	***Paragorgia* sp.**	*Paragorgia arborea*
8	1	2012	***Paragorgia* sp.**	*Paragorgia arborea*
8	2	2012	***Paragorgia* sp.**	*Paragorgia arborea*
9	1	2013	*Cyclohelia lamellata*	Bryozoan (*Rhamphostomella* sp.)
9	2	2013	*Errinopora* sp.	Alcyonacea
10	1	2013	*Parastenella* sp.	*Plumarella* sp.
10	2	2013	*Calcigorgia* sp.	*Thouarella* sp.
10	3	2013	***Paragorgia* sp.**	*Paragorgia arborea*
10	4	2013	***Fanellia* sp.**	*Fanellia* sp.
10	5	2013	*Alaskagorgia aleutiana*	*Primnoa* sp.
10	6	2013	Scleractinia	Porifera
10	7	2013	***Thouarella trilineata***	*Thouarella* sp.
10	8	2013	*Calcigorgia spiculifera*	*Plumarella* sp.
10	9	2013	***Cryogorgia koolsae***	*Cryogorgia koolsae*
10	10	2013	**Alcyonacea**	Alcyonacea (*Anthomastus* sp.)
10	11	2013	Coral (unidentified)	*Thouarella*/*Plumarella*
10	12	2013	Coral (unidentified)	Hydroid
10	13	2013	**Alcyonacea**	Alcyonacea

10	14	2013	***Muriceides nigra***	*Muriceides nigra*
10	15	2013	Antipatharia	Hydroid
11	1	2013	***Plumarella* sp.**	*Plumarella* sp.
12	1	2013	***Fanellia* sp.**	*Fanellia* sp.
12	2	2013	***Plumarella* sp.**	*Plumarella* sp.
12	3	2013	***Thouarella* sp.**	*Plumarella superba*
12	4	2013	***Thouarella/Plumarella***	*Plumarella* sp.
12	5	2013	*Fanellia* sp.	*Arthrogorgia* sp.
12	6	2013	***Primnoa* sp.**	*Primnoa* sp.
12	7	2013	***Paragorgia arborea***	*Paragorgia arborea*
12	8	2013	***Paragorgia arborea***	*Paragorgia arborea*
12	9	2013	***Calcigorgia* sp.**	*Calcigorgia beringi*
12	10	2013	***Plumarella* sp.**	*Plumarella* sp.
12	11	2013	***Muriceides nigra***	*Muriceides nigra*
12	12	2013	***Muriceides nigra***	*Muriceides nigra*
12	13	2013	**Alcyonacea**	Alcyonacea (*Anthomastus* sp.)
13	11	2013	***Fanellia* sp.**	*Fanellia* sp.
13	12	2013	***Muriceides nigra***	*Muriceides nigra*
13	13	2013	***Primnoa* sp.**	*Primnoa* sp.
13	14	2013	**Alcyonacea**	Alcyonacea (*Anthomastus* sp.)
14	1	2013	*Errinopora* sp.	Demospongiae
14	2	2013	***Fanellia* sp.**	*Fanellia* sp.
14	3	2013	***Plumarella* sp.**	*Plumarella* sp.
14	4	2013	*Cyclohelia lamellata*	Demospongiae
14	5	2013	***Muriceides nigra***	*Muriceides nigra*
14	6	2013	***Thouarella* sp.**	*Thouarella* sp.
14	7	2013	Antipatharia	Hydroid
14	8	2013	*Distichopora borealis*	Demospongiae
14	9	2013	*Distichopora borealis*	Demospongiae
14	10	2013	*Distichopora borealis*	Demospongiae
14	11	2013	***Plumarella* sp.**	*Plumarella* sp.
14	12	2013	*Cyclohelia lamellata*	Demospongiae
14	13	2013	***Muriceides nigra***	*Muriceides nigra*
14	14	2013	*Distichopora borealis*	Demospongiae
15	1	2013	*Muriceides nigra*	*Calcigorgia beringi*
16	1	2013	***Paragorgia arborea***	*Paragorgia arborea*
16	2	2013	***Arthrogorgia* sp.**	*Arthrogorgia* sp.
16	3	2013	***Alaskagorgia aleutiana***	*Alaskagorgia aleutiana*
16	4	2013	***Muriceides nigra***	*Muriceides nigra*
16	5	2013	***Fanellia* sp.**	*Fanellia* sp.
16	6	2013	***Thouarella* sp.**	*Thouarella* sp.
17	1	2013	***Muriceides nigra***	*Muriceides nigra*
17	2	2013	Coral (unidentified)	*Calcigorgia beringi*
17	3	2013	Primnoidae	*Plumarella superba*
17	4	2013	Coral (unidentified)	*Cryogorgia koolsae*
17	5	2013	Coral (unidentified)	*Stylaster* sp.

17	6	2013	***Paragorgia arborea***	*Paragorgia arborea*
18	1	2013	*Parastenella* sp.	*Plumarella* sp.
19	1	2013	Coral (unidentified)	Alcyonacea
19	2	2013	*Arthrogorgia* sp.	*Fanellia* sp.
19	3	2013	Coral (unidentified)	*Plumarella* sp.
19	4	2013	Coral (unidentified)	Alcyonacea (*Anthomastus* sp.)
19	5	2013	Coral (unidentified)	*Primnoa* sp.
19	6	2013	Coral (unidentified)	*Stylaster* sp.
19	7	2013	Coral (unidentified)	*Muriceides nigra*
20	1	2013	Coral (unidentified)	*Muriceides nigra*
20	2	2013	Coral (unidentified)	Alcyonacea (*Anthomastus* sp.)
20	3	2013	Coral (unidentified)	*Paragorgia arborea*
20	4	2013	Coral (unidentified)	*Stylaster* sp.
20	5	2013	Coral (unidentified)	Demospongiae
20	6	2013	Coral (unidentified)	Demospongiae
20	7	2013	Coral (unidentified)	*Primnoa* sp.
20	8	2013	Coral (unidentified)	*Calcigorgia beringi*
20	9	2013	Coral (unidentified)	*Thouarella* sp.
20	10	2013	Coral (unidentified)	*Plumarella* sp.
20	11	2013	Coral (unidentified)	Alcyonacea
20	12	2013	Coral (unidentified)	Demospongiae
20	13	2013	Coral (unidentified)	*Fanellia* sp.
21	1	2013	***Paragorgia* sp.**	*Paragorgia arborea*
22	1	2013	***Thouarella* sp.**	*Thouarella* sp.
22	2	2013	***Thouarella* sp.**	*Plumarella* sp.
22	3	2013	***Muriceides nigra***	*Muriceides nigra*
22	4	2013	*Muriceides nigra*	*Fanellia* sp.
22	5	2013	***Plumarella* sp.**	*Plumarella* sp.
23	1	2013	***Swiftia pacifica***	*Swiftia pacifica*
24	1	2013	***Paragorgia* sp.**	*Paragorgia arborea*
25	1	2013	Hydrocoral	Demospongiae
25	2	2013	Hydrocoral	Demospongiae
26	1	2013	*Calcigorgia* sp.	*Primnoa* sp.
27	1	2013	*Parastenella* sp.	*Plumarella* sp.
28	1	2013	***Primnoa* sp.**	*Primnoa* sp.
28	2	2013	***Primnoa* sp.**	*Primnoa* sp.
29	1	2013	**Alcyonacea**	Alcyonacea
30	1	2013	***Stylaster campylecus***	*Stylaster* sp.
30	2	2013	***Fanellia compressa***	*Fanellia* sp.
30	3	2013	Gorgonian	*Paragorgia arborea*
31	1	2013	***Paragorgia* sp.**	*Paragorgia arborea*
32	1	2013	Coral (unidentified)	Demospongiae
32	2	2013	Coral (unidentified)	Demospongiae
32	3	2013	Coral (unidentified)	Demospongiae
32	4	2013	Coral (unidentified)	Macroalgae
33	1	2013	***Fanellia* sp.**	*Fanellia* sp.

33	2	2013	*Primnoa* sp.	*Cryogorgia koolsae*
33	3	2013	***Muriceides nigra***	*Muriceides nigra*
33	4	2013	*Fanellia* sp.	*Plumarella* sp.
33	5	2013	***Plumarella* sp.**	*Thouarella* sp.
33	6	2013	*Paragorgia arborea*	Alcyonacea (*Anthomastus* sp.)
33	7	2013	Coral (unidentified)	Alcyonacea
34	1	2013	***Primnoa* sp.**	*Primnoa* sp.
35	1	2013	*Acanthogorgia* sp.	*Calcigorgia beringi*
35	2	2013	Antipatharia	Hydroid
36	1	2013	Coral (unidentified)	Demospongiae

Appendix III. -- Questionnaire given to observers to provide feedback on the coral identification project.

Coral Identification Project Questionnaire

1. Did you encounter any corals on this trip? If so, which species did you identify?

2. In which region(s) and fishery did you encounter corals (e.g., bottom trawl cod in the Aleutians)?

3. Were you able to confidently identify the corals that you encountered? How much time did you spend on identifying corals?

4. How did the field guide work for you? Do you think it is adequate and easy to use?

5. Do you have any suggestions about how we could improve the field guide?

6. Do you have any suggestions about how we could improve the coral identification training?

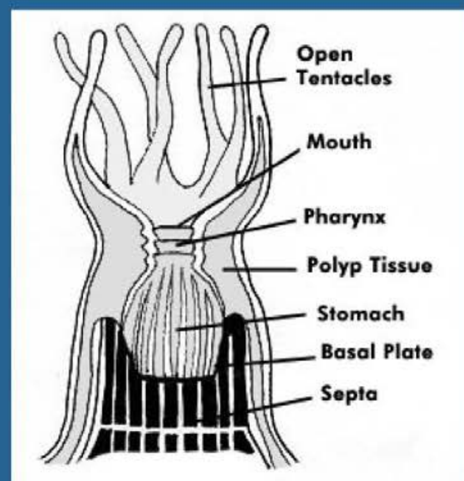
7. Please feel free to list any additional comments you have about coral identification.

Appendix IV. -- Simple tutorial provided to all observers beginning in 2014.

A tutorial to assist observers in the field identification of corals

This short presentation is designed to assist groundfish observers in identifying corals to the order level in the field. It is essentially a more detailed version of the two-page coral guide provided as part of the observer identification manual. Representative specimens are on display in the glass case near the observer training room.

Corals are primarily colonial organisms classified in the phylum Cnidaria, along with jellyfishes, sea anemones, hydroids, and others. A coral colony usually consists of hundreds of individual polyps, variously arranged on a hard or soft skeleton. This guide includes the six major groups of corals commonly encountered as bycatch in the groundfish fisheries of Alaska. Although many of the corals of Alaska are quite distinctive at this level, more specific identification can be quite difficult in the field. In addition, some other groups of benthic invertebrates, including bryozoans and sponges, can sometimes be difficult to distinguish from corals.



Structure of a coral polyp

If possible, **identify all corals in your sample to the appropriate order**. If you are unsure, the "coral unidentified" code (32) is still available. As with fishes, photographs are always helpful (see example), and **representative specimens should be labeled and collected whenever possible**.

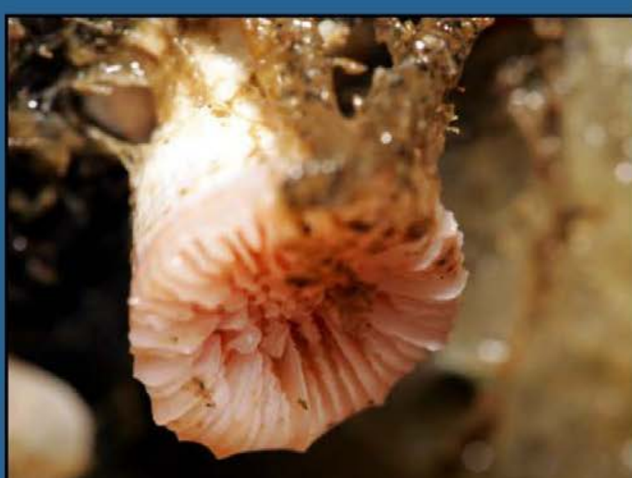
NMFS, Alaska Fisheries Science Center, Seattle, WA – December 2013

Hydrocorals (Anthoathecatae)

All hydrocorals are colonial with a **hard inflexible calcareous skeleton**. Hydrocorals have **very small polyps embedded in skeletal pores.** Colonies may be up to one meter tall and wide but are often highly fragmented on deck as they are extremely fragile. Colonies are typically upright, and may be uniplanar (flat), bushy or variably branched with lamellar (flat blades), flabellate (fan-shaped) or digitate (finger-like) branches. Dead specimens are usually bleached.

Stony corals (Scleractinia)

All stony corals in Alaska are small solitary 'cup' corals with a hard calcareous skeleton. Polyps are embedded in a calyx (or cup) with septae arranged in a radial pattern from the center of the calyx. Specimens are typically fragile and collected specimens may be fragmented. Live specimens have soft tissue in the calyx that produces mucus when stressed. Dead specimens are often bleached and may be encrusted with sand and other organisms (tube worms etc.). Calyx color is white, light pink or light brown.

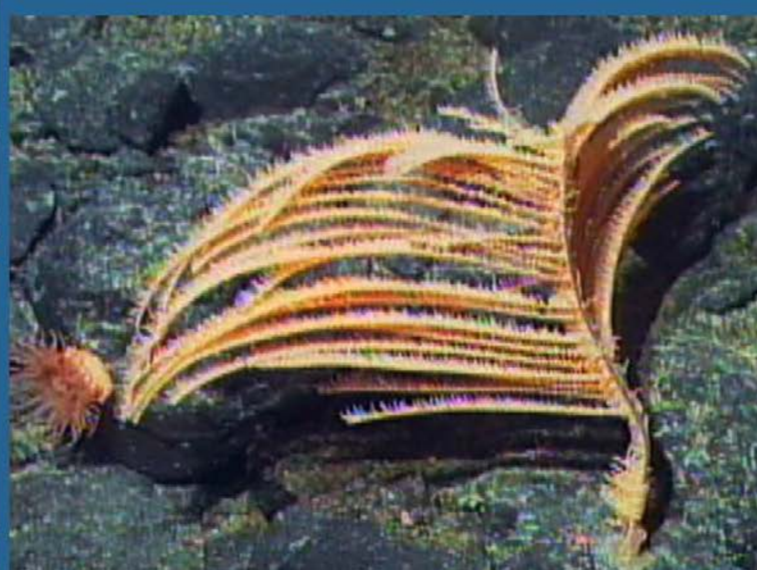


Gorgonians (Gorgonacea)

All gorgonians are colonial, and the colonies may be bushy or uniplanar and quite large (more than 1 m tall or wide). On deck, specimens resemble small trees, fans, or bushes. The internal skeleton is firm but flexible and may be 'woody' (dark protein material) or calcified (white bone-like) to some degree. Healthy colonies always have tissue covering the skeleton whereas dead specimens have exposed skeletons. Polyps are generally small, and most are retractile, with a few exceptions. This group includes the bubblegum coral, red tree coral, bamboo coral, and many others.

Black corals (Antipatharia)

All black corals are colonial. **Axial skeleton is black or dark brown**, highly flexible and covered with small thorn-like projections. Live specimens are covered with a **mucus-rich** soft tissue with small non-retractable polyps. On deck, specimens generally resemble small trees, fans, bushes, or whips. Colonies are often attached to small cobbles, pebbles, or pieces of mudstone. Black corals are primarily deepwater species.



Soft corals (Alcyonacea)

Soft coral colonies have variably shaped fleshy bodies without an axial skeleton. Polyps are mostly retractile, but not always. Often attached to pebbles, sediment or other corals. **On deck, specimens resemble mushrooms, berries, or cauliflower**. Color is highly variable and may be red, pink, brown, purple, or orange.

Sea pens and sea whips (Pennatulacea)

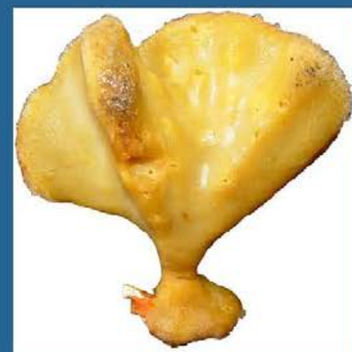
Colonies consist of an **elongated fleshy stalk supported by an internal stiff calcium carbonate rod.** The upper part of the main stalk supports rows of polyps or branches with polyps; the lower part bears an enlarged fleshy peduncle without polyps. Sea pens live in soft sediment so are not attached to pebbles, sediment or other corals. Sometimes only the stiff calcium carbonate rod is brought up in the net.

Other Benthic Invertebrates

Several other groups of benthic invertebrates are commonly confused with corals.

Sponges: no internal skeleton, may be branched, usually soft and "squishy"





Bryozoans: highly variable in shape and size; no single field characteristic consistently distinguishes them from corals



Hydroids: usually small and delicate, without internal skeleton, highly branched



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