GORGONIAN CORALS

TAXONOMY

Scientific name: Class Octocorallia, Suborders Scleraxonia, Holaxonia, and Calcaxonia
Common name: Sea fans, bamboo coral, red tree coral, bubblegum coral, Kamchatka coral
Taxonomic comments:
A large, diverse group of 18 recognized coral families in the phylum Cnidaria (formerly phylum Coelenterata). At least 27 species in 6 families are found in Alaska. These include: *Alaskagorgia aleutiana*, *Keratoisis profunda*, *Lepidisis paucispinosa*, *Muriceides cylindrica*, *M. nigra*, *Swiftia beringi*, *S. pacifica*, *S. simplex*, *Calcigorgia spiculifera*, *Arthrogorgia kinoshitai*, *A. otsukai*, *Fanellia compressa*, *Fanellia fraseri*, *Plumarella flabellata*, *P. longispina*, *P. spinosa*, *Primnoa resedaeformis*, *P. willeyi*, *P. pacifica*, *Thouarella straita*, *T. hilgendorfi*, *Paragorgia arborea*, *P. pacifica*, *P.* sp., and *Amphilaphis* sp. (Cimberg et al. 1987, Heifetz 2002, Andrews et al. 2002, Sanchez and Cairns 2004, Williams and Cairns 2004). Recent work suggests the three species of *Primnoa* may be synonymous and could be placed within species *P. resedaeformis* (Andrews et al. 2002.)

DESCRIPTION

Basic description: A colonial marine coral with a rigid skeleton.

General description:
Tissues are composed of polyps grouped together in colonies which resemble a plant, with a short main trunk fastened to ocean bottom substrate and lateral branching stems which may or may not be in the same plane. Individual polyps are small (usually <1 cm long) simple animals with a mouth surrounded by 8 tentacles (Brusca and Brusca 2003). Two of the more recognizable species of Alaskan gorgonian corals are bubblegum coral, *Paragorgia arborea*, and red tree coral, *Primnoa resedaeformis*. Bubblegum coral forms colonies over 2 m in height, branches in many planes and has a cream-white or red color; red tree coral colonies grow to 3 m in height, often branch in one plane, and have a bright red color in living tissues (NMFS 2004d). When dried and polished, the red tree coral has a golden sheen that in the past made it extremely valuable commercially for jewelry (Cimberg et al. 1987).

Reproduction:
Sexual reproduction occurs between male and female polyps; female polyps harbor eggs which are fertilized by sperm from male polyps. Fertilized eggs develop into planula larvae either within female polyps, in a mucous coat on the colony surface, or outside the colony in the sea (Cimberg et al. 1987, Brusca and Brusca 2003). Planula larvae can survive for 3-10 days and leave the parent body to swim, crawl, sink or float in currents to a new location nearby where they metamorphose into young polyps (Cimberg et al. 1987). A small fraction of planulae reach this stage; many are

lost by landing on unfavorable substrate, eaten by predators or smothered by sediment. In some species, colonies may also produce additional polyps asexually; the colony continues to grow by budding polyps and secreting more skeletal material (Cimberg et al. 1987).

Ecology:
Gorgonians shelter fish and create habitat occupied by communities with high biodiversity (Krieger and Wing 2002). Fish species associated with gorgonian coral colonies include rockfish, *Sebastes* spp., sablefish, *Anoplopoma fimbria,* Atka mackerel, *Pleurogrammus monopterygius*, and arrowtooth flounder, *Atheresthes stomias* (Witherell and Coon 2000, Krieger and Wing 2002, NMFS 2004c). A study of gorgonian corals in the Gulf of Alaska found 10 megafaunal groups associated with *Primnoa* colonies. Members of these groups either fed on polyps, used the branches for suspension feeding, or sought protection (e.g. sea stars, nudibranchs and snails were polyp feeders; crinoids, basket stars, anemones and sponges were suspension feeders; rockfish, shrimp and crabs were protection seekers). In areas with coral, each group used *Primnoa* almost exclusively at depths >300 m (Krieger and Wing 2002). Growth rates range from 0.15-7.88 cm/yr and age spans may reach hundreds of years (Andrews et al. 2002)

Migration:
Sedentary.

Food:
Suspension feeders that obtain food from the water column using either nematocyst adhesion or mucous-net entrapment. In nematocyst adhesion, stinging cells called cnidae (or nematocysts) on the tentacles of polyps inject toxins into zooplankton prey species which are then digested. Mucous-net entrapment is accomplished by spreading thin mucous threads or sheets (flocs) over the surface of the colony to collect plankton raining down from water above, then using cilia to move the food to polyp mouths (Brusca and Brusca 2003). Colonies must be oriented with the current to feed, and broken or tipped-over corals may die even if they remain on the sea floor (Krieger 2001 in Enticknap 2004).

Phenology:
Unknown, but some corals undergo synchronous spawning over large areas within species and also between different species (Brusca and Brusca 2003).

Habitat:
Hard ocean bottom substrate of boulders and/or exposed bedrock free of sediment, from 10-3,500 m deep, at temperatures around or above 3.0° C. *Primnoa* spp. prefer temperatures >=3.7° C and depths of 10-800 m. Bamboo corals (*Keratoisis* and *Lepidisis* spp.) can live at temperatures <3.0° C and depths of 300-3,500 m (Cimberg et al. 1987).

STATUS

Global rank: GNR
Global rank reasons:
Not ranked as a group.

State rank: SNR
State rank reasons:
No rank given for gorgonian corals as a group. Currently, not enough information available on individual species to assess status ranks.

DISTRIBUTION AND ABUNDANCE

Range:
Global range:
Present in both warm/shallow-water and cold/deep-water marine habitats throughout the world's oceans.

State range:
Based on results of trawl research surveys and incidental fishery catch data collected 1954-1998, gorgonian corals are found in deep waters from Dixon Entrance in Southeast Alaska to Attu Island in the Aleutian chain, in the Gulf of Alaska, and in the Bering Sea (Witherell and Coon 2000). Frequent reports of *Primnoa* spp. in Chatham Strait, Frederick Sound and Behm Canal in Southeast Alaska, in Paramanoff, Uganik, and Uyak Bays off Kodiak and Afognak Islands. Few to no reports from the Bering Sea, Prince William Sound and bays on the southeast side of Kodiak and Afognak Islands (Cimberg et al. 1987). The few known locations of gorgonian corals in the Bering Sea occur along the outer continental shelf near the Pribilof Islands and St. Matthew Island (Heifetz 2000).

Abundance:
Global abundance:
Unknown. Highest relative abundance of gorgonian corals, in general, was believed to be in warm/shallow oceans until recent discovery of diverse coral communities, including gorgonians, in cold/deep oceans off Japan, Tasmania, New Zealand, eastern and western USA and Alaska, Nova Scotia, Brazil, Norway, Sweden, UK, Ireland and Mauritania (Marine Conservation Biology Institute 2004). In Alaska, highest relative abundance is near the Aleutian Islands, followed by Gulf of Alaska, and lowest relative abundance in the Bering Sea (Heifetz 2002).

State abundance:
Highest relative abundance near the Aleutian Islands and in the Gulf of Alaska, rare in the Bering Sea (Heifetz 2002). In the Aleutians, highest catch per unit effort (CPUE) was recorded near Attu, Agattu, Kiska and Amilia Islands; in the Gulf of Alaska, near the Kenai Peninsula and Dixon Entrance; in the Bering Sea near the Pribilof Islands and St. Matthew Island (Heifetz 2002). Found more frequently toward ocean entrances and farther from fjords, as well as more frequently along the west than the east side of bays in the Gulf of Alaska and near Kodiak Island, probably due to swifter currents near major channel entrances (providing a food source and reducing sedimentation) and/or greater turbidity and lower salinity in fjords (some gorgonians are believed to be especially sensitive to salinity and sedimentation levels) (Cimberg et al. 1987).

Trends:
Global trend:
Unknown.

State trend:
Unknown.

EXISTING PROTECTION

Global protection:
See State protection below.

State protection:
In the U.S., the Magnuson-Stevens Fisheries Conservation and Management Act (MSA; Public Law 94-265), amended by the Sustainable Fisheries Act (SFA; 1996), requires the National Marine Fisheries Service (NMFS) minimize adverse impacts to essential fish habitat (EFH) by the fisheries it manages (EFH defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity," which includes gorgonian coral communities) (Heifetz et al. 2003). An amendment adopted to the North Pacific Fishery Management Council's Ground fish Fishery Management Plan (FMP) for the Gulf of Alaska and Bering Sea fisheries identified habitat areas of particular concern (HAPC) as living substrates in shallow and deep waters, including corals (NMFS 2003, 2004b). Another amendment to the same FMP would limit harvest of HAPC biota which provide important fish habitat, and establish marine protected areas near Attu and Kiska Islands in the Aleutian Islands and areas off the Kenai Peninsula and Dixon entrance in the Gulf of Alaska where mobile fishing gear (trawls, dredges) are excluded (NMFS 2004b, c). Final action on this amendment by the North Pacific Fishery Management Council has not yet been taken but HAPCs must be designated and a process for preservation developed by August 2006 (NMFS 2004a). Gorgonian corals are currently protected in Southeast Alaska, where trawling is prohibited in a 52,600 nmi^2 area (Witherell and Coon 2000).

CHALLENGES

Global challenges:
Physical causes of mortality include smothering by sand/sediment, toppling of colonies by heavy storm waves, and exposure to freshwater runoff or air at extreme low tides (Cimberg et al. 1987). Biological causes of mortality include inter-specific competition with other species of coral and predation. Human-related concerns include degradation of habitat due to thermal and chemical pollution from power plants, sewage pollution, and damages incurred during oil extraction. Damage to colonies from commercial fishing gear including bottom trawls, long lines and pots is of immediate concern (Cimberg et al. 1987, Witherell and Coon 2000, NMFS 2004c). The slow growth, high longevity and ecological importance of many species of gorgonian corals and the habitats they create make this group vulnerable to disturbances that damage or remove colonies (e.g. bottom fishing activities) which may take over 100 years to recover from damage (Andrews et al. 2002). Long-term climate change and ocean warming could also pose a threat to deep/cold-water gorgonians.

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Damage to colonies from commercial fishing gear including bottom trawls, longlines and pots is most immediate concern (Cimberg et al. 1987, Witherell and Coon 2000, NMFS 2004c). A study of trawling effects in the Gulf of Alaska demonstrated that a single trawl pass damages and reduces density of large epifaunal invertebrates including corals (Freese et al. 1999), and a review of 20 studies that measured effects of mobile fishing gear on structural habitat features found similar effects in each (Auster and Langton 1999). Commercial trawling in the Gulf of Alaska was extensive in the 1960's and 1970's, and an average of 40 metric tons of corals were taken as bycatch in the Bering Sea and Aleutian Island bottom trawl fisheries annually between 1997 and 1999 (Enticknap 2004). The slow growth, high longevity and ecological importance of many species of gorgonian corals and the habitats they create make this group vulnerable to disturbances that damage or remove colonies (e.g. bottom fishing activities). Recovery from damage may take over 100 years (Andrews et al. 2002). Long-term climate change and ocean warming could also pose a threat to deep/cold-water gorgonians.

RESEARCH AND INVENTORY NEEDS

Global research needs:
See State research needs below.

State research needs:
Comprehensible keys to the identification of corals (e.g. Wing and Bernard 2004) should be prepared and distributed to commercial fishery observers to aid field identification and increase records of species presence and abundance in different locations. Research needed on the amount of bycatch per fisheries management unit by species and by year. Research needed on the long-term effects of bottom trawling on colonies and epifaunal biodiversity.

Global inventory needs:
See State inventory needs below.

State inventory needs:
Quantitative data on gorgonian coral distribution and abundance sorely needed. A synthesis of existing literature, catch records, and fisheries observer documentation may provide valuable information on species distribution and historical abundance.

CONSERVATION AND MANAGEMENT NEEDS

Global conservation and management needs:
See State conservation and management comments below.

State conservation and management needs:
Gorgonians are of particular concern because they provide important shelter for rockfish and other fish species, they are long lived, easily damaged by fishing gear, and slow to recover from damage (Heifetz 2000, Witherell and Coon 2000, Krieger and Wing 2002). Lack of protection for fish habitats, including coral communities, contributes to declines in fisheries (Fluharty 2000); recognition of this fact means management and conservation efforts should focus on community preservation instead of individual species. Protection from damage by mobile fishing gear should

be continued in marine protected areas. Establish new marine protected areas in areas of gorgonian coral abundance. Bycatch in fisheries is poorly documented and requires regulation.

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