A CAVE OBLIGATE AMPHIPOD

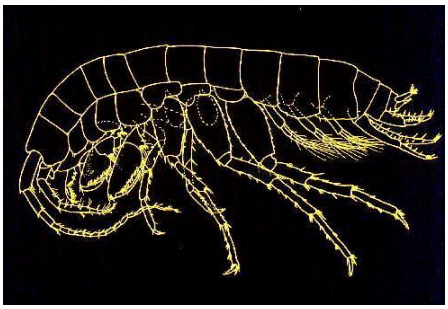
Stygobromus quatsinensis Holsinger and Shaw, 1987
(Crangonyctidae)

Global rank G2G3 (02Dec1999)
State rank S2S3 (04Aug2004)
State rank reasons
A recently described species; suspected rare. Known only from karst formations on coastal islands adjacent to Prince of Wales Island in the Alexander Archipelago; distribution information is likely incomplete. Sensitive to disturbance of karst habitat by human activity which could alter water infiltration rates, sediment production and debris transport, and water chemistry.

Taxonomy
Recently described species (1987) on Vancouver Island, British Columbia. All members of the genus are stygobiont (obligate to subterranean waters). Closely related to other members of the phylogenetic hubbsi group but discovery of this species may cause revision of the physical characters used to define the group (see Holsinger and Shaw 1987).

General description
Blind, unpigmented subterranean amphipod. Medium sized groundwater species distinguished by presence of 2 or 3 submarginal setae on distal part of posterior margin of propod of gnathopod 1, inserted below defining angle; and absence of distal peduncular process on uropod 1 of male (Wang and Holsinger, 2001). Largest female 7 mm, largest male 6.3 mm; male and female generally similar except for slight differences in gnathopod and uropod appendages (Holsinger and Shaw 1987).

Ecology
Occurrence on Coronation Island, southeastern Alaska, represents the western hemisphere high latitude record for any cave adapted species (Carlson 1996). Method of origination in current locations is unknown; apparently occurs only on coastal islands such as Vancouver Island, BC, which has been isolated from mainland North America for around 40 million years. Known distribution may be the result of subterranean communities remaining stable through periods of glacial coverage (cave-adapted fauna are perhaps the only invertebrates that could survive glaciation in situ) or radiation from existing southern mainland populations after glaciers



receded (Holsinger and Shaw 1987, Carlson 1997a).

Food Thought to be a predator-scavenger of organic matter that falls below the surface of cave drip pools and streams; uses mouth appendages (gnathopods) to capture food (Carlson 1997b).

Habitat
Occurs in resurgence areas of limestone caves or karst formations; in cave streams, springs or drip pools with substrates of mud, pebble, cobble or bare rock. Water bodies characterized by small amounts of organic matter, low temperatures (3.0 to 8.5°C) and pH of approximately 7.5-8.0 (Holsinger and Shaw 1987, Carlson 1997a, Carlson 1997c). Organic matter enters karst system in runoff, seeps and streams, is broken down by microscopic organisms, and provides nutrients and energy to cave inhabitants (Carlson 1997b).

Global range
Caves on Vancourver Island, British Columbia, and elsewhere on Vancourver Island caves and in karst groundwater habitats in the Alexander Archipelago of southeastern Alaska (Wang and Holsinger, 2001).

State range
In Southeast Alaska, occurs in karst groundwater habitats in the Alexander Archipelago, including Nautilus cave, Heceta Island, and in numerous springs and caves on Dall, Baker, Sumez and Coronation Islands adjacent to Prince of Wales Island (Carlson 1994, 1996, 1997a, Holsinger et al. 1997).

State abundance
Unknown. A study of aquatic and terrestrial cave-associated invertebrates in Southeast Alaska found overall species abundance and richness decreased as collection sites progressed from east to west and from north to south (i.e., higher species abundance closer to Prince of Wales

Island and mainland Alaska); overall abundance per collection site was low (<10 organisms) (Carlson 1997a).

Global trend
Unknown.

State trend
Unknown.

State protection
In the US, the Federal Cave Resources Protection Act of 1988 safeguards caves on federal lands by regulating use, requiring permits for removal of cave resources, prohibiting destruction, and allowing for cave locations to remain confidential and requiring that caves be included in land management plans (New Mexico Center for Wildlife Law 1998). Directed by this act, the Tongass National Forest in Southeast Alaska included standards and guidelines for cave and karst management in the 1997 Tongass Forest Plan Revision Final EIS, which includes assessment of "karst vulnerability" for karst resources to any land use (USFS 2002). Around 467,600 acres of soluble rock (where karst formations occur, usually in limestone and marble) underlie lands currently administered by the Tongass National Forest. Fifty-three percent of that acreage is managed under a Wilderness Group or Natural Setting Land Use Designation (LUD) and is protected from development or resource harvest. The remaining 47 percent is in Development LUDs, and more than half of this area is mapped as suitable for timber harvest. However, through "karst vulnerability" assessment, more acreage may eventually be managed protectively (USFS 2002).

State threats
Cave-adapted species are perhaps the most sensitive of all invertebrates to disturbance or impact; their extremely specific habitat requirements and physiological traits make them unable to compete with terrestrial/surface-dwelling invertebrates (Carlson 1997b). One of the largest challenges regarding this species is disturbance of cave or karst habitat, especially by human activity. Timber harvest, road building and other development can affect water infiltration rates, sediment production and debris transport, and introduce pollutants or organic materials which can alter water chemistry (USFS 2002). Temperature changes in aquatic environments resulting indirectly from anthropogenic effects are another concern and may be the greatest threat to aquatic organisms geographically constrained to certain karst areas (Carlson, pers. comm.). Anthropogenically introduced non-native invertebrate species (including the collembolan *Willowsia* and Formicid ants) can also threaten cave-dwelling communities (Carlson 1997a).

State research needs
Research to determine life history and specific habitat requirements should be a priority. Genetic studies of local populations on Vancouver Island and Southeast Alaska should be conducted to help establish dispersal timing and provide important information on colonization of offshore islands (Shaw and Davis 2000).

State inventory needs
Recent description of this species and its distribution suggests new occurrences of *S. quatsinensis* may be found in the future; further exploration of freshwater cave and karst aquatic habitats should be undertaken to establish full geographic range. Catalogue and inventory all known occurrences.

State conservation and management needs
Conservation of cave and karst habitats should be a high priority. Careful environmental and faunal studies before and after timber harvest could help assess degree of threat as a result of habitat alteration.

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Acknowledgements

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Life history and Global level information were obtained from the on-line database, NatureServe Explorer (www.natureserve.org/explorer). In many cases, life history and Global information were updated for this species account by Alaska Natural Heritage Program zoologist, Tracey Gotthardt. All Global level modifications will be sent to NatureServe to update the on-line version.

Global NatureServe Conservation Status Factors Edition Date: 24Jun2004
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