SYNOPSIS OF THE

DRAFT FISHERY MANAGEMENT PLAN

FOR SEA CUCUMBERS IN SOUTHEAST ALASKA

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INTRODUCTION

Developing fisheries for sea cucumbers in Southeast Alaska have been managed by permits, most of which have been issued for areas near Ketchikan and Sitka. These permits specify fishing periods, locations, and gear. In some cases, management subareas have been created, rotational area openings implemented, and catch quotas instituted.

From 1983 through 1988, the sea cucumber fishery in Southeast Alaska was small, and it was unclear whether these fisheries would be economically viable. During this period, annual landings reported by a handful of divers varied between zero in 1985-86 to 50,000 pounds in 1988. However, escalating prices and other factors led to a 30-fold increase in landings to 1.3 million pounds and a 20-fold increase in the number of divers to 97 divers in 1989. These trends continued into 1990. Approximately 792,000 pounds were landed in 1990 through March compared to 118,000 pounds for this same period in 1989.

The phenomenal growth of the sea cucumber fishery has caused or aggravated a number of problems for management. These problems need to be resolved before the department can re-open the fishery: 1) reliable information on the distribution and abundance of the organism needs to be obtained; 2) research needs to begin on key life history parameters which govern growth, maturity, longevity and recruitment; 3) management measures need to be developed that minimize localized depletion; 4) conflicts between traditional subsistence users and commercial divers need to be resolved. A management plan needs to be developed and staffing to administer the fishery needs to be obtained.

BIOLOGY AND LIFE HISTORY

The commercial or giant red sea cucumber (*Parastichopus californicus*) is one of the echinoderms, which is a group of closely-related animals that includes sea urchins, sand dollars, starfish, brittle stars, and sea lillies. This species occurs from Baja California to the Gulf of Alaska from intertidal waters to depths of at least 817 feet.

Because most biological studies have been conducted in Washington state and British Columbia, only inferences can be made about life history parameters of this species in Alaska. As with many species, differences are likely to occur at more northern latitudes, such as slower growth, later maturity, and greater maximum size and age.

Sea cucumbers attain a size of maturity and commercial harvest of about 1.1 pounds at ages 4-8. They reach a maximum length of about 1.5 feet. Although techniques to determine true age have not been

developed, analyses of size frequencies suggest that they reach ages in excess of 12 years in British Columbia.

Adults appear to prefer habitats with rocky or shelly bottoms. They are epifaunal deposit feeders that ingest the uppermost layers of mud, sand and detritus. Larvae settle in the proximity of adults perhaps due to pheromone attractants released by adults. However, juveniles appear to be rarely found with adults, and seem to prefer beds of red algae or marine bristle worms that may afford camouflage protection from predators such as starfish.

Little dimorphism exists between males and females. Broadcast spawning occurs over a protracted period, and often occurs during bright, sunny days. The largest females produce several million eggs. Larvae are pelagic for 50-90 days and perhaps longer in the cool waters of Alaska. Recruitment success of larvae to the bottom is variable.

Commercial sea cucumbers have peculiar seasonal cycles. In autumn they appear to migrate to deeper waters, stop feeding, and demonstrate greatly reduced activity. During fall and winter, their digestive, respiratory, circulatory, and reproductive systems atrophy. During this period their body wall loses around 25% of weight, and respiration occurs directly through the body wall. Visceral regeneration commences during January and February. Feeding, growth, and development progress during spring. In summer, adults may migrate to shallow waters for spawning and continued feeding and growth.

OVERVIEW OF SEA CUCUMBER FISHERIES

Dive fisheries for the commercial sea cucumber occur in California, Washington state, and British Columbia. Sea cucumber products are imported by Asian markets, such as Taiwan, and Asian communities in cities, such as New York, San Francisco, and Vancouver, British Columbia. Muscles strips are frozen, and skins are boiled and dried to produce a product known as *trepand* or *beche de mer*, which is used in Oriental cuisine.

Harvest of the commercial sea cucumber began in 1971 in Washington state. Landings were 3,000-15,000 pounds through 1976 and fluctuated between 27,000-421,000 pounds through 1987. From 1987 to 1988 prices nearly doubled ($0.33 versus $0.56 per pound), the number of vessels quadrupled, and landings increased nearly seven-fold to 1.9 million pounds. This trend continued in 1989 when 2.5 million pounds were landed. Regulations were adopted to limit the fishing period to May 1 to October 31, prohibit fishing on Sundays, institute a four year rotational plan for management districts, and implement fishery closures due to overfishing in some areas. Also, the fishery may become limited entry in 1990.

A small fishery began in British Columbia in 1980, increased to 1.2 million pounds in 1983, and further expanded to 4.2 million pounds in 1988. Canada's existing management policy is to provide for a severely restricted fishery until fiscal resources become available to support stock assessments and life history studies.

Fisheries for sea cucumbers in California began in 1981. Catches are mostly composed of a different species, *Parastichopus parvimensis*. This is a smaller species that generally prefers shallower water than *P. californicus*.

In Alaska, the sea cucumber fishery started in 1983-84 when 256-290 pounds were landed annually. No landings were reported in 1985-86. Reported catches increased to 45,000 pounds and 50,000 pounds in 1987 and 1988, respectively. During 1983-88 catches were taken by 13 or fewer participants and seven or fewer vessels each year. Due to price escalation and other factors, from 1988 to 1989 landings grew thirty-fold to 1.3 million pounds, the number of registered vessels increased from five to 68, dive permits grew from five to 97, and the number of landings escalated from 155 to 1,379. Through 1989, sea cucumber fisheries in Alaska have been confined to the southeastern region of the state. By April of 1990, over 900,000 pounds had been landed by about 125 participants. The number of permits issued during the first week in April was about three per day.

FISHERY MANAGEMENT GOAL AND OBJECTIVES

A fishery management plan is being finalized for the commercial sea cucumber fishery in Southeast Alaska and a draft will be available around mid-May. The management goal for this draft fishery management plan is to maximize the overall long-term benefit of sea cucumber resources to the state of Alaska and its residents, consistent with responsible stewardship for conservation of sea cucumber populations and their habitats. This goal is composed of four objectives.

The biological conservation objective is to ensure the long-term reproductive viability of sea cucumber populations and the quality and availability of their habitats. The subsistence objective is to ensure that sea cucumber harvest requirements by traditional users in coastal communities are satisfied. The sustainable and orderly fishery objective is to ensure the conduct of manageable, steady-paced sea cucumber fisheries that provide stable employment opportunities and sustained supplies of high quality product to seafood markets. Last, the adaptive management and research objective is comprised of two sub-objectives. The first sub-objective is to a conduct fishery research program that leads to a continually-developing, sound information base on sea cucumber biology, population dynamics, and stock responses to alternative harvest strategies. The second sub-objective is to enact adaptive management programs that conduct controlled fishing experiments to evaluate optimal management strategies and to establish fishery management plans that are flexible to accommodate these new insights into management.

ALTERNATIVE FISHERY MANAGEMENT MEASURES

A long list of alternative management measures were evaluated with respect to the fishery management goal and objectives. Many were rejected.

Bag limits were rejected, because they do not to prevent overfishing. Increasing numbers of participants will lead to increasing catches, despite bag limits. Size limits were rejected, because sea cucumbers have the ability to change shape. Length, width, and weight measurements are not reliable. Therefore, it would not be possible to enforce size limits. Sex restrictions are not viable due to difficulties in determining the sexes without dissection.

Effort limitations, such as limited entry or individual transferrable quotas, were rejected, because the department does not have the authority to implement such programs. Additionally, the Commercial Fisheries Entry Commission is constrained in the manner in which fisheries are limited. For example, effort can only be limited to some historic level. Although it is doubtful that effort in 1983-1989 was optimal, effort limitation may be desirable in the future to meet conservation and orderly fishery objectives.

Different harvest policies were considered, including fixed escapement goal, constant catch quota, and pulse fishing through unregulated harvest, but these were rejected. Fixed escapement goals are ill-advised when stock-recruit relationships and population dynamics are unknown. Fixed catch quotas would not be prudent, because they would lead to overharvest or underharvest of most sea cucumber stocks. Pulse fishing through unregulated harvest is unacceptable, because resource conservation is not maintained.

PREFERRED MANAGEMENT MEASURES

The draft fishery management plan contains a set of preferred management measures designed to meet the four objectives concerning biological conservation, subsistence, sustainable and orderly fisheries, and adaptive management and research. Above all, management measures were chosen to provide for conservative harvests for the following reasons. Sea cucumbers have a relatively low age at first maturity, low maximum age, low mean asymptotic weight, and high natural mortality (estimated to be 27% per year). Species with these life history traits tend to have low maximum yield per recruit. This

particular species is vulnerable to overfishing, because adults slowly repopulate overharvested areas by migration, larvae appear to settle only in areas with adults, and recruitment appears to be irregular.

Preferred management measures under Alaska's traditional open access fishing policy include permit/reporting requirements that require fishing permits and vessel registrations. Logbooks and fish tickets are also required to provide data commensurate with orderly fisheries and adaptive management/research. Gear limitations are hookah gear and SCUBA/free diving. Mechanical harvesting practices, such as trawls and dredges, would not be permitted. Fishing seasons are defined to be September 1 through April 30. These dates were chosen to prevent harvest during peak spawning through early settling periods. Closed waters are established to create refuge areas as protection against overharvest, subsistence areas to prevent deleterious impacts of the commercial fishery on availability of sea cucumbers to subsistence users, and experimental management areas to provide new insights into the advantages of alternative management strategies. A map depicting proposed stock boundaries, subsistence areas considered for commercial closure, and refuge or experimental management areas is attached. Quotas will be established for each area to insure biological conservation. Initially, catch quotas will be set equal to 3% of the virgin stock biomass, which must be estimated before areas are open to commercial harvest. Given annual assessment surveys, which are critical for realistically estimating abundance, catch quotas would be set at 3% of standing stock biomass. Monthly or quarterly openings were designed to attain the sustainable and orderly fishery objective by providing for manageable fisheries, stable employment, and sustained supply of products to seafood markets. In addition, if other allocation strategies, such as fixed day openings each week are found to be acceptable, they will be considered. Inseason adjustments are needed to react to events or new data that bear upon attainment of management objectives.

RECOMMENDATIONS

The draft fishery management plan includes the preferred suite of management measures to achieve the management goal and objectives. However, this plan cannot be implemented without funding an integrated management, stock assessment, and research program. This long-term program must include stock assessment surveys to implement harvest policies that provide for conservation of sea cucumber resources. Staff are also needed to manage the fishery and to collect, edit and analyze fish tickets, logbooks, and assessment data. Last, we desperately need to conduct basic research into key life history parameters such as age and growth.

Lacking the resources to implement the fishery management plan, the Division of Commercial Fisheries recommends closure of the sea cucumber fishery on May 1, 1990. On this date, the fishery would be closed by emergency order. Simply stated, full commitment of regional staff to other seasonal fisheries for species such as herring, salmon, and Dungeness crab, forgoes the ability to manage this major fishery.

Further, effort levels are escalating, there is uncertainty in stock assessments and life history parameters, and we are concerned about harvest during the major spawning period.

In autumn 1990, four options would be available to the Department. First, the fishery could remain closed, due to lack of stock assessment surveys, paucity of data on life history parameters that dictate management strategies, and inadequate staffing levels. Second, the status quo permit-based system could be reinstated. Third, an approach similar to that implemented in British Columbia could be instituted. This system would close most areas of Southeast Alaska, and greatly restrict commercial harvests elsewhere to levels so low that conservation mandates are assured. Last, a comprehensive fishery management plan could be implemented pending the adequate funding of a stock assessment, research and management program.

We recommend the last. This presupposes allocation of at least the following management and research resources and personnel.

RESEARCH AND MANAGEMENT NEEDS

Implementation of the preferred management strategy for sea cucumbers in Southeast Alaska will require an investment into assessing the distribution and abundance of stocks and to conduct basic life history research. In addition, resources are needed to administer permitting, process fish ticket and analyze log books. Funding requirements identified for the activities below presume significant reprogramming within the Southeast Region. The reprogramming involves having several department biologists already trained in the use of SCUBA assist with surveys, priority use of one department vessel to conduct assessment surveys and priority assignment of survey design and analysis to the region's biometric staff. Even though the value of these human resources will approach perhaps $150,000, little can actually be done without the operational funding to support their research and management. Furthermore, any significant reduction in either the reprogramming of funds within the region or failure to obtain new operational support will result in commensurate reduction in the areas which could otherwise be opened to fishing in the future.

Stock Assessment

While the department will initially use SCUBA to assesses the distribution and abundance of sea cucumbers, more efficient means need to be developed if the vast coast line of Southeast is to be surveyed. The most promising technology is in the use of remotely operated or towed vehicles which carry video cameras. This technology would also permit estimation of the distribution of the organism

with depth. Initial estimates of cost not considering development of video gear is $68,700. To initiate research on the use of video equipment would cost about $45,000.

Life History

Long term studies to understand the productivity of sea cucumbers would focus on how fast they grow, what their age is at sexual maturity, the rate of natural mortality and similar traits. We propose to obtain answers to these questions by establishing cooperative research program with the University of Alaska through graduate student research. The cost for a stipend and operational support for this activity is estimated to be $49,500.

Management

Costs associated with administration of the management plan include issuing permits, review and verification of logbooks and fish tickets and conduct of sampling programs at processing plants. We estimate that this activity will cost $43,600.