City of Bainbridge Island
ENVIRONMENTAL TECHNICAL ADVISORY COMMITTEE

MEMORANDUM

TO: City Council and Planning Commission

FROM: Environmental Technical Advisory Committee

DATE: July 20, 2011

RE: **Aquaculture: a summary of issues regarding aquaculture in the nearshore environment and state and municipal SMP regulatory approaches**

Bainbridge Island Environmental Technical Advisory Committee (ETAC)

This paper provides a brief overview of aquaculture in WA state and describes some of the potential changes and impacts that may be associated with aquacultural activities.[1] Steps that can be taken to avoid or mitigate effects of aquaculture on natural resources and habitats are described, and some recent local regulatory efforts are touched upon as information that may be helpful for the development of language for the Bainbridge SMP update process.

Marine aquaculture is the culturing of saltwater aquatic species such as oysters, clams, mussels, shrimp and salmon in ocean waters. It also includes stock enhancement, which is the release of hatchery raised fish and shellfish to restore populations in the marine environment (NOAA 2007). In Washington State in 2005, 194 marine aquaculture farms reported $93.2 million in sales. Atlantic salmon and Pacific oysters are the major components of Washington's total aquaculture output. Manila clams are the most popular clam, although other clams are grown. Coho salmon, trout, steelhead, and arctic char are also cultured in Washington (NOAA 2007). Geoduck is also becoming an increasingly desirable product to culture commercially in Puget Sound. Wild stock harvesting of healthy geoduck tracts occurs regularly in the Kitsap County, at least 600 feet offshore, in 18-70 feet of water.

The state of Washington has a regulatory framework in place for oversight of commercial aquaculture activities, which is complemented by a federal framework. Net pen facilities are required to have an NPDES permit, issued by the WA Department of Ecology (DOE). Both the USA and Canada have regulations about movement of aquatic animals which rely on certifications based on a history of the stock in question and the water in which the animals were raised. This is coordinated by the US government through the US Fish and Wildlife's National Aquatic Animal Health Plan (USFWS 2011), and all 50 states have complementary programs in place. Fish Health inspectors are certified through the American Fisheries Society Fish Health

[1] The reader should keep in mind that there are differing aquaculture methods and procedures for the same types of shellfish (e.g., oysters and mussels), and this document does not differentiate between details for each method.

Section, requiring minimum education and experience and an examination process. SMP regulations that address aquaculture are further discussed at the end of this document.

According to the Washington Administrative Code, aquaculture is a water-dependent use and, when consistent with control of pollution and avoidance of adverse impacts to the environment and preservation of habitat for resident native species, is a preferred use of the shoreline (WAC 173-26-241(3)(b)).

Table 1 provides a summary of potential effects associated with aquaculture activities and steps that can be taken to avoid or mitigate negative impacts associated with major categories of aquaculture (finfish and shellfish), and is followed by a narrative discussion providing more details for several of these potential effects.

TABLE: SUMMARY OF AREAS OF EFFECTS AND POSSIBLE MITIGATORY STEPS FOR FINFISH AND SHELLFISH AQUACULTURE

Type of Aquaculture	**Area of effect**	**Examples/specifics**	**Effects**	**Possible mitigation steps**
Finfish	Water Quality	Metabolic wastes	Biological Oxygen Demand (BOD) increases, Dissolved Oxygen (DO) decreases	Proper siting in high-current dispersive areas
			Growth of nuisance algae	Same as above
		Addition of antibiotics and other chemicals	Non-target effects, environmental pollution	Same as above, and also requirements to minimize or prohibit chemical use
	Foreign materials	Netting and securing devices left behind or detaching	Wildlife entanglement, degradation and entry into food web	Oversight and regulation establishing proper care and maintenance of materials
	Sediment	Substrate burial by metabolic wastes	Impacts to benthos, BOD increases/DO decreases	Proper siting in high-current dispersive areas
		Substrate disruption due to net pen siting	Localized benthic community disturbance	Proper oversight and construction to minimize effects and timing to avoid sensitive life stages of biota
	Disease	Introduction of novel or additional pathogens	Introduction or exacerbation of disease in wild fish populations	Limits on net pen fish densities; avoiding or minimizing use of areas that are critical to migratory or rearing fish populations that could be affected

Type of Aquaculture	Area of effect	Examples/specifics	Effects	Possible mitigation steps
	Accidental release	Release of aquacultured species to wild	Interbreeding/hybridization (potential uncertain)	Proper net pen maintenance to minimize risk of accidental release
			Competition for resources	Same as above
Type of Aquaculture	**Area of effect**	**Examples/specifics**	**Effects**	**Possible mitigation steps**
Shellfish	Water Quality	Filter feeding	May improve water quality, or may cause localized competition for resources	Intensity of aquaculture needs to consider site-specific carrying capacity and baseline water quality conditions
	Foreign materials	Netting and securing devices detaching or left behind	Wildlife entanglement, degradation and entry into food web	Oversight and regulations requiring proper site care and maintenance, closure plans that include materials removal and disposal
	Sediment	Removal or alteration of sediment	Changes in benthic community, removal of the benthic community, or benthic community replacement with commercial species	Baseline and ongoing monitoring to quantify effects; proper site selection to minimize the need to alter substrate, avoid critical resource areas for native nearshore communities
	Disease	Pathogen introduction or exacerbation	Transmittal of disease to wild shellfish populations (?), introduction or transmittal of diseases harmful to human consumers	Baseline testing for pathogens prior to allowing commercial use; ongoing monitoring
	Accidental release	Introduction of novel shellfish species	Hybridization or competition with native species	Federal and state oversight to screen species for invasive properties (??)

Additional details and discussion of potential ecological changes associated with aquaculture activities:

Water quality:

- Aquaculture often concentrates animals into higher densities than are found in the natural environment, which means waste products are being excreted in concentrated amounts, including fecal matter and ammonia (usually converted quickly to nitrate in most oxygenated waters). DOE attempts to address concerns about concentrated waste output by requiring standards for the siting of net pens in areas with sufficient volume and current to disperse waste material. In finfish aquaculture, supplemental feeding or the addition of chemicals and antibiotics may also contribute to water quality issues.
- Filter-feeding animals, including clams and mussels, may provide local improvements to water quality by removing particulates and chemicals from the water column. However, bioaccumulation of contaminants is possible and resultant potential risks to humans and wildlife that consumes shellfish needs to be considered. Sufficiently high densities of shellfish also may consume large quantities of plankton that is an important food resource for other species. Therefore, costs and benefits of filter-feeding are tied to the specific management objectives and to the size of the aquacultural activity.

Foreign materials:

- Both finfish and shellfish aquaculture use holding and securing devices (e.g., mesh used to cover shellfish beds, zip ties, netting) made of plastics and other foreign materials that may detach or be left behind if there is not proper care and management of onsite materials.

Sediment:

- Substrates may be dredged or manipulated in order to install or maintain aquaculture activities.
- Substrates may be buried by aquaculture wastes, such as below or downdrift of net pens.
- Substrates may be removed during harvesting (e.g., removal of intertidal sediments by high-pressure water systems for geoduck harvest)
- Substrates may be altered in order to improve conditions for the aquacultured organism (e.g., hardening the substrate by application of shell hash to improve oyster settling).
- Substrates may be scraped or disturbed by dragging of equipment such as chains or net bags.

Release of pathogens and non-native species:

- The spread of pathogens, such as sea lice from farmed Atlantic salmon, has been a cause of substantial concern in British Columbia. Higher densities of fish increase opportunity for pathogen transmission to wild native species; to date pathogens that have been found in association with aquacultured species are already found in the wild. While the spread of pathogens from aquaculture populations to wild fish is possible, so far there has not been substantive evidence of harmful effects of such transmissions on wild species. Whenever non-native species are used, the potential spread of exotic pathogens is a potential risk that is very difficult to assess a priori and can be extraordinarily damaging (e.g., whirling disease *Myxobolus cerebralis* introduced from Europe to the US via live fish shipments, *Vibrio sp*.(cholera) transported in ballast water from ships from Latin America into Mobile Bay, Alabama). Regulations in place for live fish and shellfish shipments in Washington State, together with regular screenings for pathogens of both

mature animals and their gametes, are considered a relatively effective method for avoiding this problem.

- Release of non-native species: accidental release of a non-native species into a new environment has the potential for ecological impacts on native species through several mechanisms including pathogen transmission, competition for resources, and hybridization/interbreeding. Atlantic salmon escapes have been reported in Puget Sound, and specifically there was an escape of an estimated 100,000 adults in 1997 from net pens in waters adjacent to Bainbridge Island. There was an aggressive local survey to see if those fish colonized any streams in Puget Sound, which was negative. A recent risk assessment of the potential for Atlantic salmon to escape into northwestern streams concluded that short-term risks from Atlantic salmon escapes were low but long-term risks were moderate to high for disease/parasite transmission and moderate for competition for food and rearing resources with native salmon in Pacific Northwest streams (Bisson 2006).

Predator control: Finfish cages are typically covered with nets to exclude avian and other predators.

Visual and acoustic changes: Geoduck are planted in the lower intertidal zone, surrounded by a plastic tube to protect the siphon. Some people consider these tubes unsightly. Commercial aquaculture introduces human activity and often motorized equipment into the aquatic environment.

Some notes on recent efforts to regulate aquaculture under SMPs:

Prohibition/restrictions on net pen aquaculture of finfish: Ecology rejected Jefferson County's SMP prohibition of net pen aquaculture of finfish, stating:

"A total ban on a water- dependent use such as net pen aquaculture was considered in terms of the policy rationale presented by the Board of County Commissioners. It was recognized there was considerable public support for banning net pens based on concerns about water quality and ecosystem health. Ecology considered whether there was enough discussion and evidence of a science basis in the record to support a ban. We conclude there is not a conclusive science basis on the record to support such a ban. We further determined that from a legal standpoint there is no authority for an outright ban through an SMP. A required change removes the prohibition on net pen fisheries and finfish aquaculture. A requirement for Conditional Use approval applies to both."

As of the writing of this document, Jefferson County is preparing a response arguing to uphold this prohibition, so this issue is not yet finalized.

Changes to regulations governing commercial geoduck aquaculture: Effective March14, 2011, Ecology instituted changes to SMA regulations governing commercial geoduck aquaculture, including provisions that require local governments to better review water quality, contaminated sediment and other shellfish-related data and information during the updating of local shoreline programs; underscores existing requirements for local governments to have shoreline master program policies, regulations and standards that address aquaculture; require a conditional use permit for all new commercial geoduck aquaculture and guide the administration and content of these permits; frame requirements for local commercial geoduck aquaculture project applications

and their review and permitting, including the requirement to following the mitigation sequence in WAC 173-26-201(2)(e) for avoiding or mitigating environmental impacts. Also, this includes the requirement to address the impacts from noise, lights, vehicles, gear and other aspects of commercial geoduck siting and operations; and ensure that local governments notify the public and tribes regarding proposed commercial geoduck aquaculture projects.

Whatcom County's regulations concerning aquaculture are available starting on Page 106 of their SMP at:
http://www.co.whatcom.wa.us/pds/naturalresources/shorelines/regulations/codeandmaps/pdf/SMP_CountyApproved_EcologyApproved_090323_clean_000.pdf

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