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| 1. A sustainability topic that has to do with our time on the Gato Verde is explored in more depth. Sources for this information are properly cited. |
| 2. A good explanation is given as to how this topic relates to the Beam Reach program while on the Gato Verde. |
| 3. A clear explanation is given as to what kind of impact we are having in this area and how we can lessen our impact. |

Surfactants

We use soap every day to wash our dishes and hands. Soap, by its nature, is full of surfactants. Surfactants are molecules made up of a hydrophilic (water liking) tail and hydrophobic (disliking water) head. These molecules, in certain concentrations in an aqueous solution will surround lipids on all sides creating a ‘bubble’ of oil separated from water called a micelle. This allows ‘grease’ to be broken up and washed down the drain. Anionic surfactants are some of the more wildly used surfactants in soaps and detergents; in fact Joy soap uses Anionic surfactants.

One of the major problems with surfactants is biodegradation, not mineralization, where the molecule is broken down into stable inorganic forms of nitrogen, carbon, phosphorous etc., but when the molecule is broken into other organic compounds (Sales et al. 1999). It has been shown that the anionic surfactant sodium linear alkylbenzene sulphonate (LAS) doesn’t break down well in cold saltwater conditions. After 21 days there was only 36% degradation at temperatures of 10°C and even lower percent of 4.2 at 5°C. This is particularly problematic in areas where these temperatures coincide with the reproductive cycle of various marine organisms, as their young are especially susceptible to negative effects from contact with surfactants (Sales et al. 1999).

 Anionic surfactants, in certain concentrations, are very lethal to many aquatic organisms, saltwater organisms even more so (Van De Plassche et al. 1999). Various anaionic serfactants such as linear alkyl benzene sulfonate, alcohol ethoxylates, alcohol ethoxylated sulfates, have a 50 percent mortality rate on various marine organisms in concentrations higher than dissolved levels ranging from 0.042-3.7 mg/L depending on the anionic surfactant. While a lot of soap would be needed to reach these concentrations in a body of water like a bay, the accumulative effects of many boats could get close.

Because the sinks in the Gato Verde dump directly overboard we are dumping surfactants in the water whenever we wash our dishes and hands. During two of our daily meals we are cooking and washing dishes in small harbors and bays. Depending on the tidal exchange we could be introducing a measurable amount of surfactants into the ecosystem potentially damaging the organisms therein. I calculated the tidal exchange and residency based on three different tidal heights for four of the bays we used multiple times during our 5 weeks on the water. These harbors include: Michel Bay, Westcott and Garrison Bays, North Jones and Reid Harbor. Michel Bay has the best tidal exchange (tidal exchange being the percent of total volume that leaves the bat from one tide peak to the next) followed by Westcott & Garrison Bay, Reid Harbor and finally North Jones (Figure 1). Michel bay also has takes the least amount of time flush the bay (flushing a bay being when the total volume of water is replaced with new water), followed by Westcott & Garrison Bay, North Jones and lastly Reid Harbor (Figure 2).

Figure 1. The percent of the total volume of the bays and harbors that leave from one tidal peak to the next (high to low).

Figure 2. The number of days it takes for the total volume of a bay or harbor to be replaced with new water.

 Different bays and harbors have very different rates of exchange and residency making some more susceptible to pollution effects than others.

We can mitigate our impact on the bays and harbors we use in a few different ways. We can be more conscious of our impact and choosing our anchorage for the night taking into account what the current tidal difference is, how well exchanged the bay or harbor we are staying in is, and how many days the surfactants will remain in that harbor or bay. We can also change our soap to one with less or no surfactants. Some alternatives are Ms. Meyer’s Dish Soap, a soap that has ‘natural’ plant derived surfactants in it still processed but better than completely artificial or petroleum based ones, Dr. Bronner’s Magic Pure Castile Liquid Soap, a multi-purpose soap with no surfactants, and Aubrey Organics Earth Aware All-Purpose Cleaner, another all-purpose cleaner with no surfactants. A grey water system put into the galley would also allow the Gato Verde to choose a location to dump surfactants so they would end up in very high flow areas like Haro Strait instead of small low exchange harbors like Reid Harbor.

Refrences

Sales D, Perales J A, Manzano M A, Quiroga J M. 1999. Anionic surfactant biodegradation in seawater. Boletin Instituto Espanol de Oceanografia. 15: 517-522.

Van De Plassche E J, De Bruijn J H M, Stephenson R R, Marshal S J, Feijtel T C J, Belanger S E. 1999. Concentrations and risk characterization of four surfactants: linear alkyl benzene sulfonate, alcohol ethoxylates, alcohol ethoxylated sulfates, and soap. Environmental Toxicology and Chemistry. 18: 2653-2663.

<http://www.thegreatergreen.com/naturalcleaning/mmdishsoapger.html> ms. Meyers dish soap 6/1/10

<http://www.thegreatergreen.com/naturalcleaning/aubreyearthaware.html> Aubrey 6/1/10

<http://www.thegreatergreen.com/naturalcleaning/drbpeppermintsoap.html> Dr. Bronner’s 6/1/10