

## **APPENDIX 1. Ballast Tank Filling and Refilling Recommendations (by Glenn Cota)**

Goal: Dump and pump up as frequently as needed to maintain inflow temps within 1.0 C of ambient surface water temp.

Monitoring: David Ruble and Zhi-Ping Mei will continue to monitor temperatures (air, inflow and outflow) and PAR continuously for the phyto incubators to help evaluate trends and diagnose problems. Other groups need to monitor their incubators as frequently as possible. David can incorporate other data into plots.

Observational summary: There is an initial warming of 0.5 to 1.2 C and a gradual increase (~1-2 C) over several days with diel temperature fluctuations (~1-2 C) tracking solar radiation and air temperature. There seems to be a trade off between ballast tank fill level and flow rates, with decreased flows as the tank drops to levels approaching the minimum, 30K gal. There is a transient spike of colder water (~0.5 to 1.5 C decrease for <3 h) when the tanks have been "topped up".

Constraints: Dumping (~2 h) and pumping up (6+ h) requires ~ 8 h minimum, and must be done either coming on to a station or on a not-to-interfere basis on station. Pumping can only be done on station, and does not interfere with other nonmoving science activities.

Timing: The Chief Scientist needs to be notified daily in the AM, in event of problems, and by ~18:00 before meeting with CG. Chief Scientist shall assume no news is good news, requiring no action. Strongly recommend all incubator teams convene briefly at ~17:30 in galley daily for updates.

Operational scenarios: (~in order of preference – SEE TABLE BELOW)

- 1) Dump and refill on any "cold" (~ambient surface or supply temp) nights possible.
- 2) Pump up to near maximum operational levels anytime on station.
- 3) Top up to buy time..... SEE BELOW

Action guide

<u>Supply Temp</u>	<u>Air Temp (~night differential)</u>	<u>On Station</u>	<u>Transit</u>	<u>Arrival – departure time</u>
<1.0 C above ambient	Cold (~ambient surface water or supply)	<i>Top up</i>	<i>N/A</i>	Any
<1.0 C above ambient	Warm (>ambient surface water or supply)	<i>Top up</i>	<i>N/A</i>	Any
>1.0 C above ambient	Cold (~ambient surface water or supply)	<i>Dump or lower if poss.&amp; top up</i>	<i>Dump &amp; top up asap</i>	Night
>1.0 C above ambient	Warm (>ambient surface water or supply)	<i>Top up</i>	<i>Dump &amp; top up asap</i>	Night