

## **Eilat Workshop Summary Amsterdam Meeting (January 2003)**

Present: Dror A., Kenny B, Chris C., Manolis T., Tina V., Sonja L., Martin S. and Ehud S.

Minutes taken by Liz Cook

Presentation of Results from Eilat Intensive Survey (Dror Angel)

Hypothesis – In weakly-mixed, oligotrophic systems, fish farm effluents stimulate both heterotrophic and primary production, the balance between which depends ....

Budget (Lupatsch & Kissil, 1998) – Seabream

Description of study site. Reference site >500 m. All water samples taken at 5 m depth.

Current meters deployed inside cage (5 m), underneath cage (15 m), reference site (80 west of cages).

### **Results**

- Solar irradiance (meterological data) for surface readings. PAR meter gave odd values, possible fault with electronics. Can use attenuation curve to adapt surface readings.
- Wind speed (meterological station) – change to m/s (**Action: Dror**). Cyclical changes in wind speed – reduction at night and increase during am.
- Tide and current direction – Significant changes in direction – N/ NW switches to N/ NE within 2 days. Total tidal amplitude. Produce vector plot for wind and surface current (**Action: Kenny**). Steve Brenner (IOLR Meterologist), Tal Berman (Student – Physical Oceanographer) – contact for physical data for region. Backwash trajectories – NOA database (**Action: Manolis**) – requires exact position, can wind.
- Tide and current speed – no obvious diurnal cycle. No strong correlation between tides and currents.
- Temperature – Fish farm higher temperatures than reference. Isolation of water at fish farm, increasing the retention of solar irradiance. Some cyclical pattern.
- Farm Activity – Feeding (kg food) related to sampling time. Problem – not relating data to an isolated cage. Fish different sizes and species on farm. Problem with positioning of current meter because of differences in cage net mesh size. Noticeable increase in quantity of feed fed in the morning.
- Dissolved oxygen – O<sub>2</sub> higher at reference site, may be related to lower temperatures or due to differences in activity. Requires longer term monitoring. Differences may be due to recirculation of currents. **Action: Assess current direction at different times of day and link with the sampling times.**

- pH – Large difference between ref and fish farm. Again superimpose pH data on current regime. **Compare oxygen and pH.**
- Total suspended solids – Very little difference between sites (filtered 2 litres onto GF/F filters) and low concentration of particles. C/N values – no significant difference between sites.
- % Particulate carbon (organic and inorganic) and organic nitrogen – Difficult to say if difference between sampling sites.

#### Dissolved Inorganics –

- Nitrate/ nitrites – no significant differences.
- Ammonia – Problems with method used in Eilat, really needed to filter the samples, so deterioration of particles may have produced ammonia. Manolis took sub-samples and good correlation between ammonia and feeding times. **Need to repeat ammonia measurements at site. Need to relate to current direction.**
- Phosphates – Highly significant differences. Very low at reference site. Greater values at fish farm. Increase in pm and reduction over night. Sources – excretion by fish & release from faeces and uneaten food.
- N/P ratios – Need to calculate. Redfield Ratio (106:16:1)

Chlorophyll – No diurnal pattern but may be some relationship with current direction. BUT see pigment data from Tina/ Alenka – problem though as no pre-filtration of samples. Manolis commented on the high chlorophyll levels at the reference site. Link to current patterns.

- Pigments – Certain groups showed diurnal cyclical pattern.

Bacterial Abundance – Higher populations of heterotrophic bacteria at fish farm compared to control. Need to link to current direction/ hydrography.

- Cyanobacteria – Higher population at fish farm. Good diurnal pattern.
- Production – Higher production at fish farm and follows diurnal pattern compared to ref site. Extent of grazing needs to be investigated. Tina suggested that top-down pressure from grazers is more important in influencing bacterial production than bottom-up.
- Primary productivity data (Tina)

Transects (Timor) – Fluorescence level reduced at fish farm compared with stations sampled at various distances from farm. If transect sampled ‘down stream’, chlorophyll maxima could be due to time delay (Ken C.), in addition to the bio-filter effect of farm itself (Dror).

Kenny – Movements of water could account for the patterns observed in the data shown – need for modelling (**Action: Kenny/ Chris**). Potential inclusion all cages at farm and currents/ wind data.

Dror – Production of excel spreadsheet to consolidate data from Eilat workshop. Place database on website (**Action: Liz**).

### **Relationship with hypothesis**

Bacterial production – peaks related to nutrient production by farm, ammonium/ phosphate compared to ref. Site. Suggests microbial loop is v. important around farm.

Flow cytometry – Samples still to be analysed by Dror, work needs to be justified.

Production of budget for the microbial loop around fish farm. Yannis compared budget results for Crete related to fish farms (EAS, Trieste 2002), maybe try to compare with Eilat results.

### **Manolis Presentation – Crete**

Diel variation of nutrients and chlorophyll at fish farm in Cephalonia, Greece.

Fish farm – depth 18 – 20 m

>700 tonnes of sea bream and bass per year

Samples collected 5 l niskins at 1, 10 and 20 m between cages containing approx. 140 tonnes.

Sampling before feeding in morning and repeated every 2 hours.

Diurnal cycle in ammonium and phosphate – increase only in 1 m depth. No difference observed at other depths. No differences in nitrate, nitrite and silicate.

Chl a – no difference between depths and during the day.

Micro-bioassay experiment (MEDVEG) – enclosure of surface water in dialysis bags. Permeable to small molecules and nutrients (prevents particulate material). Significant decrease in phytoplankton production over 5 days with increased distance from fish farm. Prevention of grazing and reduction of dispersion.

**Nuria's Results (Kenny)** – Monthly measurements of dissolved nutrients etc.

### **Summary**

Phosphate data

Additional data required:

Grazing

Zooplankton abundances

Influence of current direction and flow speeds on all data - modelling

Organic nutrient enrichments

Dissolved organic nitrogen and phosphate

Run all datasets through PRIMER

Presentations onto website (**Action: Liz**)

Paper

- Work on methods section (Dror)
- Results – continue to collate
- Modelling – Chris to look at modelling current direction etc. related to data collected during survey.