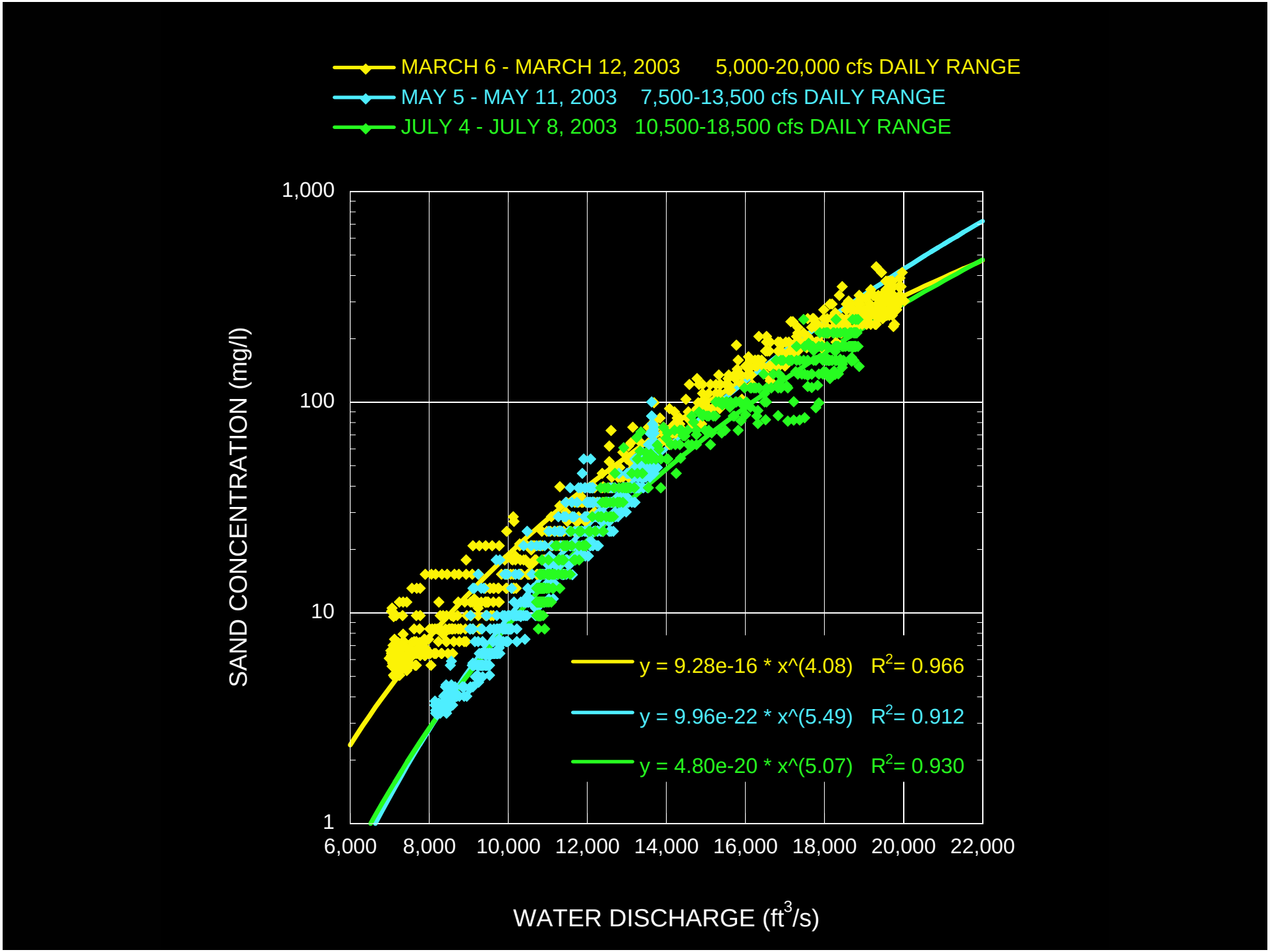
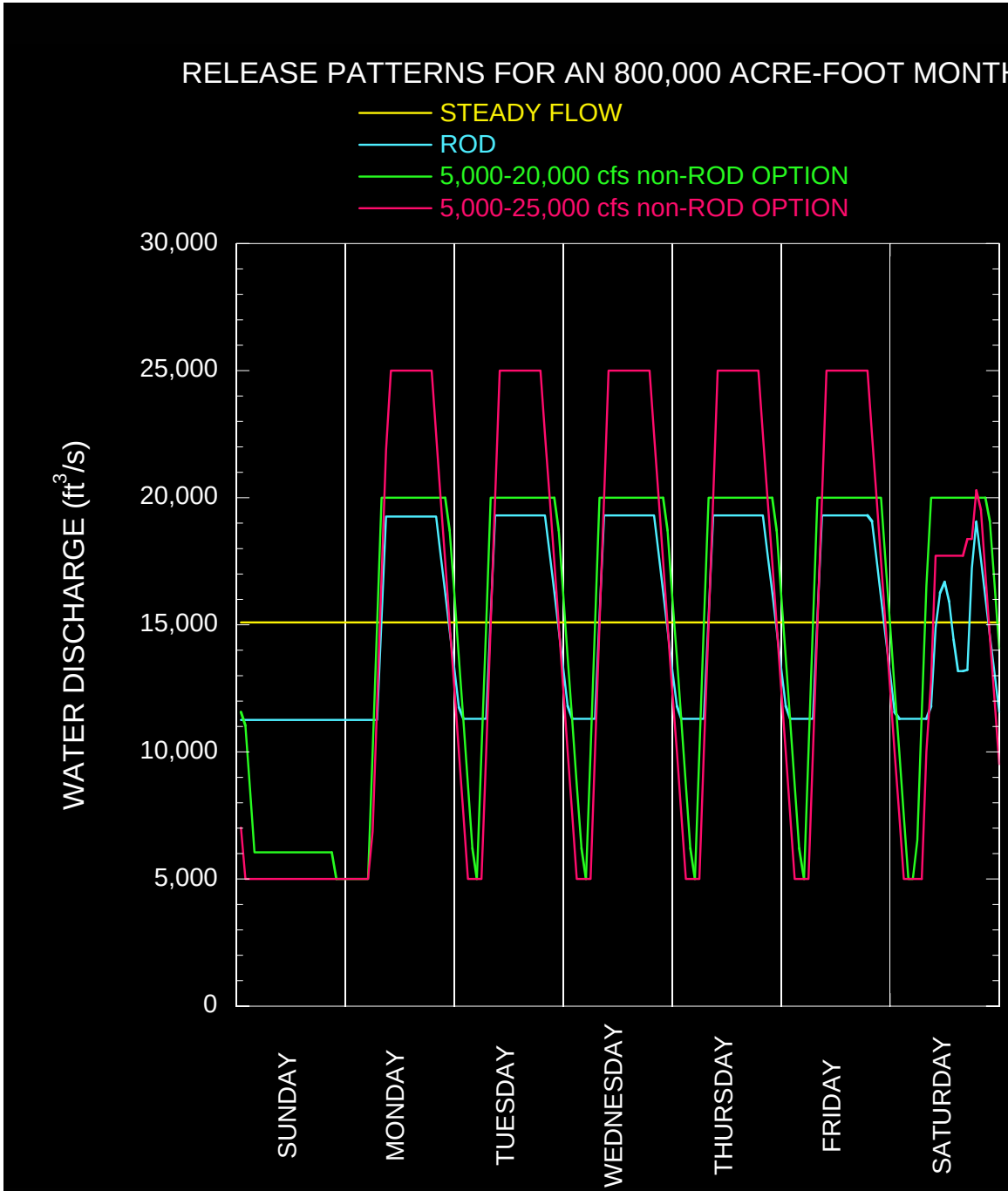
$$C \propto u_*^4 D_b^{-1}$$

Engelund and Hansen (1967),
Rubin and Topping (2001)

effect included in EIS


MARCH 6 - MARCH 12, 2003 5,000-20,000 cfs DAILY RANGE
MAY 5 - MAY 11, 2003 7,500-13,500 cfs DAILY RANGE
JULY 4 - JULY 8, 2003 10,500-18,500 cfs DAILY RANGE
1,000
100
10
1
SAND CONCENTRATION (mg/l)
y = 9.28e-16 * x^(4.08) R2= 0.966
y = 9.96e-22 * x^(5.49) R2= 0.912
y = 4.80e-20 * x^(5.07) R2= 0.930
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
WATER DISCHARGE (ft3/s)



- STEADY-FLOW SAND EXPORT = 60% OF ROD SAND EXPORT
- 5,000-20,000 cfs OPTION SAND EXPORT = 150% OF ROD SAND EXPORT
- 5,000-25,000 cfs OPTION SAND EXPORT = 290% OF ROD SAND EXPORT

Known

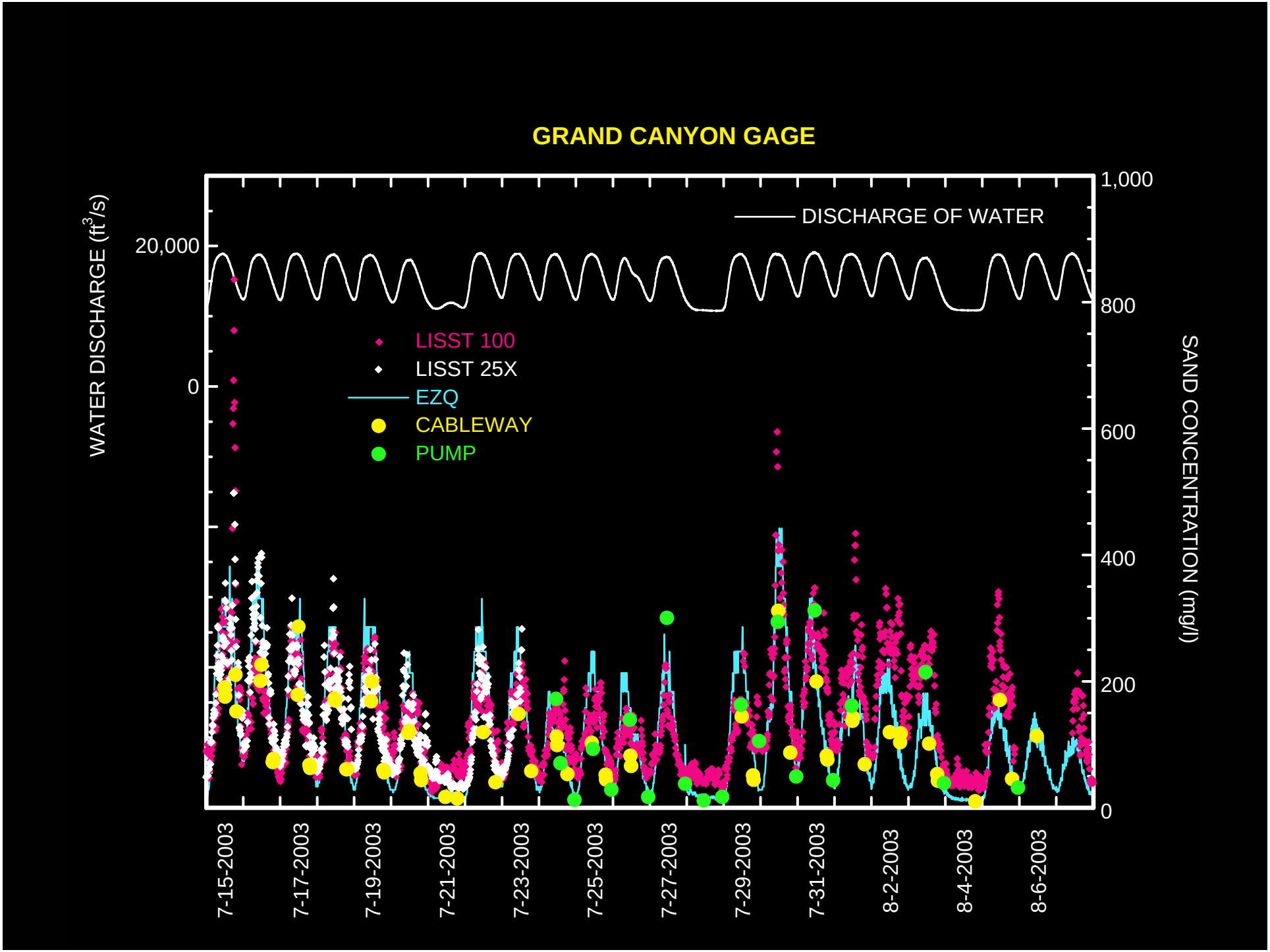
- Effects of tributary floods on suspended-sand concentration and grain size in the Colorado River
- Effects of high dam releases on suspended-sand concentration and grain size
- Effects of BHBFs and powerplant capacity releases conducted during sand-depleted periods

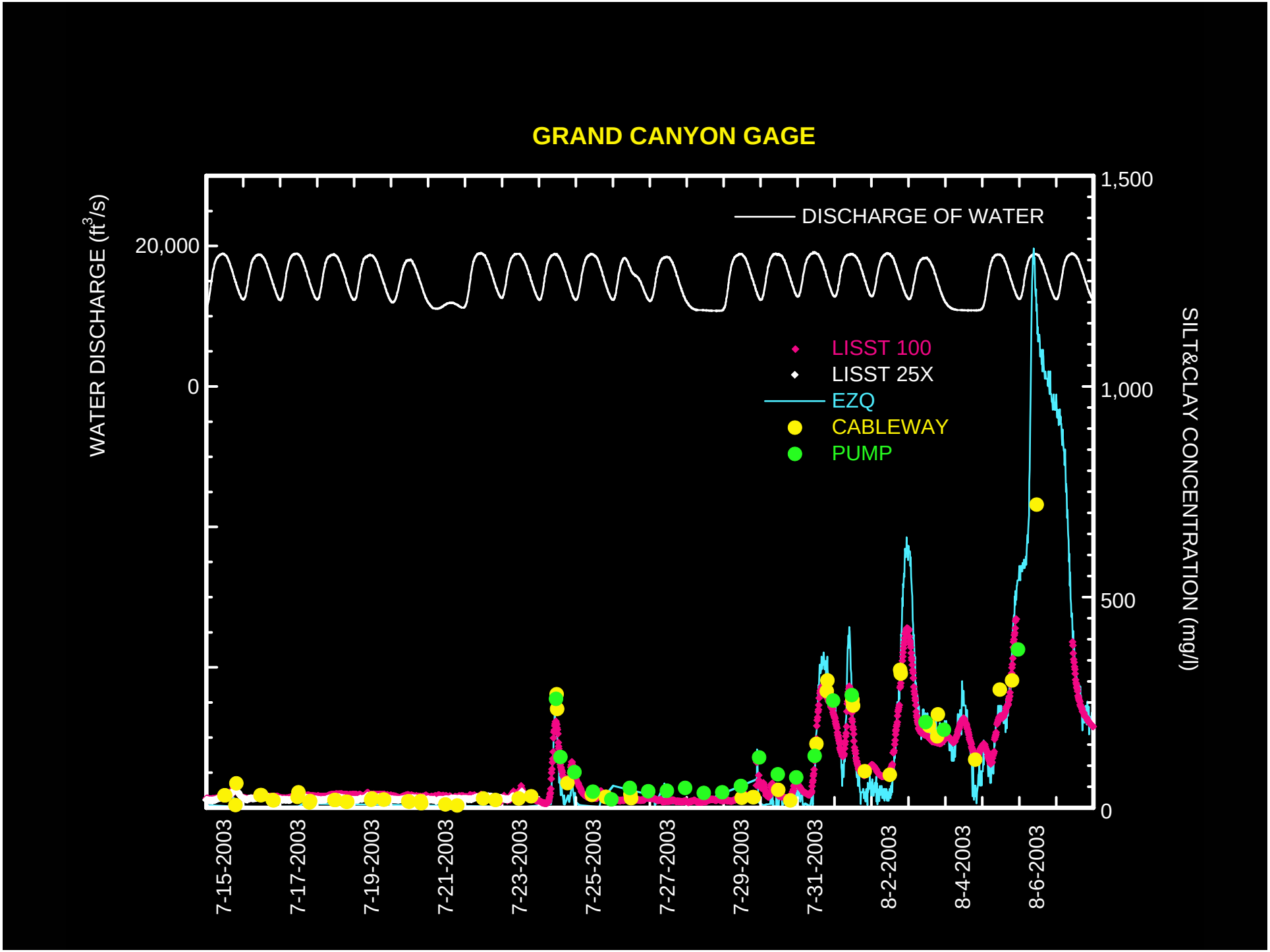
Current sediment component of the experiment

- Can average or larger inputs of Paria River sand, silt, and clay be managed (by sequences of dam releases) to offset the ongoing erosion of fine-grained sediment from Marble and Grand Canyons?…to increase turbidity over longer periods to help benefit native fish?
- WE ARE STILL WAITING FOR NATURE TO COOPERATE

Partially known

- Effect of daily range on sand concentration
- Effects of ramping rates on sand concentration


GRAND CANYON GAGE
WATER DISCHARGE (ft3/s)
20,000
0
1,000
800
600
400
200
0
SAND CONCENTRATION (mg/l)
DISCHARGE OF WATER
LISST 100
LISST 25X
EZQ
CABLEWAY
PUMP
7-15-2003
7-17-2003
7-19-2003
7-21-2003
7-23-2003
7-25-2003
7-27-2003
7-29-2003
7-31-2003
8-2-2003
8-4-2003
8-6-2003


GRAND CANYON GAGE
WATER DISCHARGE (ft3/s)
20,000
0
1,500
1,000
500
0
SILT&CLAY CONCENTRATION (mg/l)
DISCHARGE OF WATER
LISST 100
LISST 25X
EZQ
CABLEWAY
PUMP
7-15-2003
7-17-2003
7-19-2003
7-21-2003
7-23-2003
7-25-2003
7-27-2003
7-29-2003
7-31-2003
8-2-2003
8-4-2003
8-6-2003

Unknown

- Sand transfer between eddies and channel during the various experimental flow options (though most eddies will lose sand during larger fluctuations, some key eddies may actually gain sand)
- Maintenance of sandbars and backwaters by the various experimental flow options
- Importance of seepage erosion as a function of downramping rate
- Sandbar-terrestrial biological linkages under the various experimental flow options (coupled to carbon and nutrient-budgets)

The big question

If Paria River sediment inputs can be managed to offset erosion…can hydropower constraints be relaxed and fluctuating, “steady”, and BHBF flows be seasonally sequenced (a.k.a. designer flows) to achieve multiple management objectives (sandbars, turbidity, etc.) ???