March 14, 2008  Diel Vertical Migration (DVM)
1) What is the definition of diel vertical migration? Reverse diel vertical migration?
2) What are two other types of vertical migration? Give an example of an organism that
does these types of migrations.
3) What is the main environmental cue behind diel vertical migration? What evidence is
there for that particular cue?
4) What is the ecological reason organisms perform regular diel vertical migrations?
What about the reason behind performing reverse diel migrations?
5) What are deep scattering layers? Why do they move? How would you determine the
composition of the particles in the scattering layer?
6) Would you expect to find the same proportion of a community at one site in the ocean
performing this behavior all year round? Think of the Bermuda Atlantic Time Series site
in the Sargasso Sea.
7) Would you expect larger organisms or smaller organisms to display normal diel
vertical migrations? Why? Of the organisms that migrate, would you expect them to
stay at the surface for a longer time period in the winter or the summer? Why? Would
you expect latitudinal differences to affect the length of time spent?
8) How flexible is this behavior? Would you expect an organism do it to continue to
migrate in the absence of its predators? Which organism would you expect to perform
DVM – a male copepod or a female copepod with eggs? Why?
9) Describe two factors that allow a copepod, such as Neocalanus plumchrus or Calanus
pacificus, spend the entire winter (5 or more months) at depth without feeding?
10) Why do they kite diagram distributions from net tows have to be viewed with
cautions if you are “fishing” for a visual zooplankton species?
11) Why would salps migrate?
12) From a biogeochemical standpoint, how much particulate carbon would you expect
organisms that DVM to contribute to total carbon flux?

March 17 & 19, 2008  Fisheries Oceanography
1) Define “fishery”.
2) How does removing the top predator in an ecosystem potentially affect the rest of the
ecosystem? If fish are the top predators, and they are removed, what other organism
could fill their niche?
3) How would the removal of krill, or the decline in their numbers, potentially affect
Antarctic Ecosystems? What other organism type might move in to fill in the gap? How
would the large animals and birds of the system be affected?
4) How do fish change as they mature? What are the main stages of a fish’s life?
5) Would you expect fresh water fish to have more or fewer larvae? Why would
freshwater fish pursue a different strategy for reproduction relative to marine fish?
6) What is the trade-off a larval fish makes for growing faster? Why would that be a
winning strategy?
7) Define recruitment. What are some reasons it might vary from year to year? How
would over-fishing affect it?
8) Why are the first few days a larva needs to find food called the critical period?
9) What is meant by the match-mismatch hypothesis?
10) As larvae get bigger, they are more likely to survive. Why is this?
11) Define “schooling” and describe why it is a strategy for survival.
12) What difference would a 25% increase in mortality rate make in the recruitment success of a fishery? Why would increased time spent as a larvae impact recruitment?
13) Define density dependent population regulation. What are some examples of this?
14) What is the migration triangle hypothesis?
15) What is meant by a “closed life cycle”? Give an example for a fish species.
16) What are some hypotheses for how adult salmon find their way back to their home stream? What fish “sense” is most responsible for identifying the home stream?
17) What are otoliths? How are they used?
18) Give an example of how storm systems might aid in fish recruitment.
19) Give an example of how the strength of upwelling can affect fish recruitment.
20) Why are jellyfish considered an alternate top predator in marine ecosystems?

Chapter 12 Fisheries
1) As of 2000, how high have global fish landings been? What are the dominant species caught (the big five)? What do the big five have in common?
2) What is the definition of “by-catch”? Why is by-catch a problem? When is it most noticed? How does the tuna fishery exemplify this?
3) How did the industrial revolution impact fisheries?
4) What effect does government subsidies for fishing have on the industry?
5) What is ecosystem management? How does it differ from the way fisheries were managed previously?
6) What is the “spawner-recruitment relationship”? Theoretically, what shape of curve would you expect to describe this relationship?
7) What are “active” and “passive” fishing gear? Give an example of each.
8) What are some examples of technical measures used by fisheries managers?
9) Why have fishery management efforts largely failed in the past?
10) What is trawling? How does it damage the environment? How does the depth of the trawled surface relate to its probable recovery time?
11) What is meant by “essential fish habitat”?

Chapter 13 Aquaculture
1) Why are carp such ideal fish to “farm”? That is, what aspects of their biology allows them to be grown to high densities? How is this different from other fish species?
2) What is often used as fish food (fish meal) in aquacultured species? Why is this a problem? What would be a better alternative?
3) Why does figure 13.1 show aquaculture catches divided into “China” and “World excluding China”?
4) What organisms are second to fin fish in terms of tonnes of production? Why?
5) Why is it desirable to cultivate herbivorous and omnivorous fish, even though carnivorous fish fetch a better market price?
6) What is extensive cultivation? Intensive cultivation?
7) What type of aquaculture dominates, freshwater or marine?
8) What country leads the world in aquaculture production?
9) What are the main plants cultivated for aquaculture purposes?
10) What is the main environmental problem associated with shrimp aquaculture?
11) What are potential negative ecological consequences of raising genetically modified fish? How does this apply to the salmon aquaculture fishery?
12) What are fish cages? How might they adversely affect the environment?
13) How are hatchery-reared fish inferior to their wild-born brethren? What techniques are used to improve the hatchery-reared fishes odds of survival?