

**MARK SCHEME for the May/June 2011 question paper
for the guidance of teachers**

9693 MARINE SCIENCE

9693/03

Paper 3 (A2 Structured Questions), maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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- 1 (a) idea that NPP measures the available carbon that can be passed onto consumers ;
do not allow ref. to carbon used by plants
- (b) (i) 2 of:
ref. to photosynthesis releasing / producing oxygen ;
ref. to respiration consuming oxygen produced (by photosynthesis) ;
oxygen given off is that which left after the oxygen used by respiration ; [2]
- (ii) the greater the depth the lower the net primary productivity / ora ; [1]
- 2 of:
ref. to light being used in photosynthesis ;
ref. to light penetration decreasing with depth ;
ref. to light being a limiting factor in deeper waters ;
ref. to rate of photosynthesis decreasing with depth and respiration remaining unchanged ; [2]
- (c) (i) 15 °C: 6 (m) ; [1]
- (ii) 20 °C: 4 (m) ; [1]
- (iii) 3 of:
both respiration and photosynthesis involve enzymes ;
ref. to effect of temperature on enzymes ;
respiration increases more than photosynthesis at higher temperature ;
needs more light to carry out enough photosynthesis to compensate for increased respiration ;
ref. to other limiting factors ;
do not allow ref. to gas solubility related to temperature, pressure or salinity [3]
- (iv) idea of the tropical sea having lower productivity ;
answer must be related to productivity not photosynthesis [1]
- 1 of:
idea of less energy available to transfer in food chains ;
idea of plants losing more to respiration in tropics ; [1]

[Total: 13]

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- 2 (a) (i) 2 of:
as size increases oxygen consumption increases ;
not a linear relationship ; *allow descriptions*
ref. to figures ; e.g. *C is 6 × heavier than A, oxygen consumption is approx. 2 × more*
B is 2 × heavier than A, oxygen consumption is approx. 1.5 × more [2]
- (ii) 3 of:
idea that oxygen is not limiting ; *allow descriptions*
ref. to respiration rate staying constant ;
idea that rate of oxygen uptake can be adjusted ;
idea that the gas exchange surface can be adjusted (to maintain uptake) ;
idea that circulation can be adjusted (to maintain uptake / diffusion gradient) ; [3]
- (b) oxygen consumption would increase ; [1]
- 3 of:
activity requires more energy ; *allow ATP*
respiration supplies energy ;
respiration consumes oxygen ;
more oxygen needed to supply increased respiration ; [3]
- [Total: 9]
- 3 (a) (i) Southern Bluefin as it produces largest number of eggs at a time ;
allow yellow fin tuna as breeds more frequently + large no. of eggs [1]
- (ii) 2 of:
a comparison must be made for each feature
tuna spawn in sea, salmon in fresh / river water ;
tuna eggs free floating / in ocean, salmon in nests ;
tuna spawn several times during lifetime, most salmon spawn once ; [2]
- (b) Southern Bluefin tuna ; [1]
- has one specific breeding site ;
ignore any other features e.g. age to reach maturity
fewer spawning fish being caught / ora ; [2]

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- (c) (i) 2 of:
lower temperature slows metabolism / enzymes ; *allow chemical reactions*
food supply may be less ;
growth rate slower / longer to reach size to migrate to sea ;
longer to reach (sexual) maturity before their return to river ; [2]
- (ii) 2 of:
easier to catch ; *allow if refer to natural predators e.g. bears*
very few survive after spawning (so less to catch) ;
body mass bigger / lose mass as energy used in spawning ;
condition / saleability reduced after spawning ;
allow reverse arguments [2]

[Total: 10]

- 4 (a) catching fish at a level that maintains the population / maintains fish stock / AW ;
allow ref. MSY
do not allow to prevent overfishing unless qualified
with minimum damage to the environment ; [2]
- (b) (i) 1 of:
(long term interest in) ensuring that they have fish to sell ;
improve quality of the fish sold ;
attract more customers if seen to be helping conservation efforts ;
improve company image ; [1]
- (ii) 1 of:
idea of appealing their interest in conservation / environmental awareness ;
e.g. helping to maintain the marine environment ;
helping to keep jobs in fishing ;
believe it's better quality / taste ; [1]
- (iii) 1 of:
guaranteed outlet for their fish at reasonable price ;
long term employment prospects / will always be fish to catch ;
ref. to improvement in size of fish / saleability of fish caught ;
do not allow higher income / more fish to sell [1]
- (c) (i) 1 of:
ref. to less employment (as fishing is restricted) ;
ref. to lower income ; [1]
- (ii) 2 of:
~~other~~ trades supporting fishing also retained ; *allow examples e.g. ship repair*
shops stay in the area ;
other amenities also remain ; *e.g. entertainment, schools*
allow reverse arguments
do not allow answers related to fish stocks, fishing employment or tourism [2]

[Total: 8]

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- 5 (a) (i) sea water at 30 °C $6.2 \pm 0.1 \text{mg} / \text{dm}^{-3}$;
freshwater at 15 °C $9.6 \pm 0.1 \text{mg} / \text{dm}^{-3}$;
max 1 mark if units not given
- (ii) oxygen depletion caused by respiration / metabolism ;
allow ref. to greater oxygen capacity of water at lower temperature, ignore salinity
higher temperature increases rate of respiration / metabolism ; [2]
- (iii) *One mark for each method and one mark for a suitable advantage*
- method:* have a water flow bringing in fresh oxygenated water ;
advantage 1 of: carries waste from the tank / prevents accumulation of toxins ;
relatively low cost ;
- method:* pump in oxygen from cylinders ;
advantage: idea of can control the concentration / volume of the oxygen supply ;
- Allow:*
method: grow algae / water plants ;
advantage: photosynthesis produces oxygen into the water ; [4]
- (b) (i) idea that: (protein is used for growth) so fish eat more of a low protein diet to achieve same growth ; [1]
- (ii) idea that: (using a high protein diet) the fish may use some of protein for energy / low protein diet contains other energy sources ; [1]
- (c) 1 of:
diet that gives the most rapid rate of growth ;
higher quality food may produce higher quality fish ;
ref. to availability of food source ;
ref. to storage / spoilage of food source ;
do not allow ref. to protein content [1]

[Total: 11]

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- 6 (a) 2 of:
prevents the attachment / growth of algae / barnacles on ship bottom ;
growth adds to mass and reduces speed of travel / increases drag ;
increases cost of fuel ;
- (b) (i) *broad spectrum* : idea of a wide range of different types organisms ;
toxicity: idea of kills / poisons living organisms ; *allow damages / harms* [2]
- (ii) idea of bioaccumulation / biomagnification ; *allow descriptions* [1]
- (c) (i) 1 of:
ref. to more ships in coastal water ;
ref. to ships staying in harbour so more paint lost ;
ref. to more shell fish trapping / aquaculture in coastal regions (using treated nets) ;
allow examples e.g. lobster pots [1]
- (ii) 1 of:
ref. to bound into sediment (so breakdown is very slow) ;
ref. to some (older) ships still have TBT paint (so being released into water) ;
ref. to illegal use of paint ;
idea of: increase in large size shipping that can use TBT paint ; [1]
- (d) (i) the higher the TBT the slower the growth rate of oysters ;
allow inverse relationship [1]
- (ii) 2 of:
idea that the number of saleable / large oysters produced would decrease ;
idea that the number of oysters reaching maturity would decrease ; *ignore ref. to imposex*
ref. to the effect on the population of oysters ;
ref to levels above $2.00 \mu\text{g dm}^{-3}$ oysters decrease rate of growth / oysters being killed ;[2]

[Total: 10]

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- 7 (a) suitable measurements ;
e.g. length × width 150 mm × 70 mm
allow cm measurements. allow range length 140 to 150 mm, width 68 to 70 mm
- correct conversion to km ; e.g. = $\frac{150 \text{ mm}}{20 \text{ mm}} \times \frac{70}{20 \text{ m}} \times (1 \text{ km})$
- correct answer from figures with units ; e.g. = $7.5 \times 3.5 = 26.25 \text{ km}^2$;
allow ecf from figures shown on Fig. 7.1 as km [3]
- (b) (i) 2 of:
ref. to (fish) breeding grounds ;
ref. to rare / endangered species ;
ref. to biodiversity ;
ref. to aesthetic value ;
ref. to ecotourism ; [2]
- (ii) inshore ; [1]
- 1of:
ref. to breeding grounds (of turtles / land crabs) / habitat of juvenile fish ;
ref. to fragile ecosystem / named ecosystem ; e.g. mangroves [1]
- (c) (i) 2 of:
trawling damages the sea bed / benthic zone ; allow coral reef
stirs up sediment that damages gills / blocks light ;
kills bottom dwelling plants / animals that are part of the ecosystem ; allow descriptions
e.g. part of food chain / webs
allow reference to by-catch that dies [2]
- (ii) 2 of:
ref. to local needs for employment ;
ref. to traditional occupation in the area ;
ref. to idea of netting being more sustainable ; e.g. limited catch size / more control over
size of catch
ref. to economic need for export / holiday trade ; [2]
- (d) (i) idea of wrecks become habitats for marine organism / form an ecosystem ;
allow idea of disturbance to ecosystem of wreck removal e.g. damage to coral / sea bed
by lifting gear or ship anchorage
- (ii) idea of angling only catches a limited number of fish ;
allow idea of attraction for sport fishing / tourist attraction
- (iii) idea of wake damaging shoreline / animals / spilling pollutants ; allow noise pollution /
examples of plants or animals e.g. manatee [3]

[Total: 14]