M19/4/ENVSO/SP1/ENG/TZ0/XX/M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

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Environmental systems and societies

Standard level

Paper 1

12 pages

Subject details: Environmental systems and societies SLP1 markscheme

Mark allocation

Candidates are required to answer **ALL** questions. Total = **[35]**.

1. A markscheme often has more marking points than the total allows. This is intentional.

2. Each marking point has a separate line and the end is shown by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.

10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

1. Philippines; **[1]**

2. Indonesia has a declining birth/fertility rate due to increase in female empowerment /equality/education/later marriages / Timor-Leste has a high birth/fertility rate due to less access to education for women;
Indonesia has a declining birth/fertility rate due to access to contraception/family planning / Timor-Leste has higher birth/fertility rates due to lack of access to contraception/family planning;
Indonesia has lower infant/child mortality/lower death rates/higher life expectancy due to improvements/access to medicine/public health / Timor-Leste has high death rates/low life expectancy due to limited access to healthcare;
Indonesia has increasing urbanization/migration from rural areas to cities which results in a lower birth rate / Timor-Leste has a high birth rate due to large rural population where children are required to work in agriculture/support parents/religious/cultural reasons;
Indonesia has introduced population policies/publicity campaigns to reduce fertility rates;
age-gender pyramid for Indonesia is in millions whereas for Timor-Leste it is in thousand because of differences in population size; **[2 max]**

Do not accept statements without accompanying reason eg "Indonesia has a high life expectancy."

Do not accept "Timor-Leste is a less developed country / Indonesia is more developed / stage of demographic model" as a reason.

Do not accept "Indonesia has greater land which allows for a larger population/Timor-Leste has smaller land area which accounts for smaller population".

Do not accept only "healthier lifestyle / medical status".

3. $(\frac{605}{798} \times 100) = 75.81\,(\%) / 75.8\,(\%) / 76\,(\%)$; **[1]**

4. high diversity of habitats/variety of habitats provide a variety of niches that supports high fish diversity / high diversity of habitats/seagrass/corals/mangroves leads to high diversity of fish;
variety of habitats provide different food sources that support a wide range of fish species;
variety of habitats provide different breeding/nursery grounds for diversity of fish;
variety of habitats provide different shelter/protection from predators which increases fish diversity; **[2 max]**

Accept converse statements eg fewer niches outside coral triangle result in less fish diversity.

Accept use of "animal diversity" as an alternative for "fish diversity".

Do not accept 'availability of resources'.

5. reduction in sharks/marlin (predators) of the tuna (due to reduction in food source);
increase in micronekton/predatory fish (prey) of the tuna (due to reduction in predation);
reduction in phytoplankton/mesoplankton/microplankton due to increase in micronekton population;
loss of tuna reduces competition for food (micronekton/predatory fish) resulting in overall increase in sharks/marlin population;
to compensate for loss of tuna, shark/marlin eat more micronekton/predatory fish resulting in overall decline of micronekton/predatory fish population;
to compensate for loss of tuna, shark/marlin eat more micronekton/predatory fish resulting in an increase in phytoplankton/mesozooplankton/microzooplankton population; **[2 max]**

Accept other reasonable responses.

Do not credit the same marking point twice eg reduction in sharks and reduction in marlin.

Do not accept only "collapse of marine food web" or "reduction in biodiversity".

6. (a) it does not occupy land (needed for population / housing / wilderness area) / less deforestation;
fewer resources/inputs required / it is cheap/free (if harvested themselves);
there is natural income available (if harvested sustainably)/annual yield from natural capital;
it satisfies cultural preferences;
diverse range of species/food available (within Coral Triangle);
high in nutrients/protein/essential minerals such as iodine;
weather events (droughts/floods/hurricanes) are less likely to destroy food sources; **[1 max]**

Accept other reasonable responses.

Do not accept "more carbon stored / improves water quality".

Do not accept only "provides source of fish/shellfish/profit / rarity of fish / high value of fish / is a healthier food supply / biodiverse ecosystem / easy accessible / no transport cost / is replenishable / increase in diversity of species".

(b) production is more efficient because of less loss of light energy;
it is more efficient because food chain is shorter / more efficient as food is harvested from lower trophic level;
it is more readily harvested because it is less dispersed;
easier to harvest / less dangerous / requires less equipment;
greater diversity of food products/crops / people decide what to grow;
reduces threat to marine habitats from overfishing / reduces damage to marine ecosystems from fishing / reduces overfishing rates / conserving marine ecosystems can make them more attractive for recreational use/tourism;
good growing condition in the area for crop growth / high levels of insolation and rainfall (tropical conditions) in the area promote rapid crop growth; **[1 max]**

Accept other reasonable responses.

Do not accept "absorbs/stores carbon dioxide / contains large number of nutrients".

Do not accept only "sell goods".

7.

explanation	**corresponding effect**
mangroves trap/filter sediments/particulates/suspended solids from the water;	…reducing turbidity/increasing light penetration for phytoplankton/seagrass/coral; ...reducing deposition of sediment on reef systems, smothering/choking the reef;
mangroves absorb nutrients from water;	…reducing threat of eutrophication (leading to hypoxia/anoxic conditions that would adversely affect phytoplankton/seagrass/coral);
mangroves remove heavy metals/toxins/chemical pollutants from water;	…that would poison less tolerant phytoplankton/seagrass species/coral species;
mangroves reduce coastal erosion thereby limiting sediment flow into the ocean;	...this maintains water clarity/light penetration required for photosynthesis/ phytoplankton/seagrass/coral; ...reduces sediment deposition on reef systems that smothers/chokes the reef;
mangroves drop their leaves into the water, which in turn decompose and increase nutrient levels;	...this improves growing conditions for primary producers;

[4 max]

*Max **[2]** for each effect and corresponding explanation.*

*Max **[2]** if only explanations are stated.*

Award mark for the explanation even if corresponding effect is wrong/too vague/absent.

Do not credit effect if explanation is incorrect (eg prevents eutrophication because mangroves absorb carbon dioxide and release oxygen).

Do not accept just "improves/maintains water quality".

Do not accept just "increase/decrease in water turbidity/clarity" without explaining the corresponding effects

Do not accept just "reduces coastal erosion" without link to increased sedimentation.

Do not accept responses that explain how consumers would benefit.

8. would reduce protection from waves/currents/storms / increase in damage to seagrass community from waves/currents/storms;
could reduce food source for some seagrass species;
could reduce spawning areas/nursery grounds for some seagrass species;
could increase/decrease predation pressure on seagrass species from other marine species;
without coral to filter the water, the water clarity would decline adversely affecting seagrass / an increase in water turbidity, making it difficult for light fixation/photosynthesis by seagrass;
loss of coral reefs will reduce tourism to the area thereby reducing funds available for protection of seagrass ecosystems; **[2 max]**

Do not accept only "there is loss of biodiversity".
Do not accept only "increase/decrease in water turbidity/clarity" without impact on seagrass.

9. higher water temperatures could lead to coral bleaching/death;
higher water temperatures could change migration patterns of some species/cause some species to migrate to cooler water;
higher water temperatures could adversely affect reproduction of some species;
higher water temperatures leads to loss of biodiversity because some species are unable to adapt/have a very narrow acceptable temperature range;
higher water temperatures decreases dissolved oxygen levels resulting in death of fish;
higher temperatures could increase gross primary productivity/warm water species;
higher temperatures can cause mangroves to dry out that reduce habitat for some species;
ocean acidification/lower water pH adversely affects calcifying species/shellfish/corals/calcareous plankton;
more intense/frequency of storms/currents could damage coral reefs/seagrass/mangroves /coastal ecosystems;
sea-level rise could reduce (shallow water) conditions required for mangroves/corals/seagrasses / sea-level rise could flood mangrove ecosystem;
sea-level rise could increase coastal erosion / sea-level rise could increase sediment flow into the ocean reducing light penetration/primary production within marine coastal ecosystems;
increase in precipitation could lower the water salinity that can adversely affect some species / lower precipitation could increase water salinity that can adversely affect some species; **[2 max]**

Do not accept only "WWF predictions" without reference to specific factor altered by climate change that leads to specified impact on ecosystems within Coral Triangle.

Do not accept only 'climate change / change in temperature'.

N.B "Higher temperature" is acceptable for "higher water temperature".

10. mangroves/tropical rainforest mitigate climate change/reduce CO_2 in the atmosphere by absorbing CO_2;
mangroves sequester/remove a greater amount of CO_2 (per unit area) than the other ecosystems/tropical forest / mangroves are more efficient at storing carbon than tropical forests / mangroves are more effective carbon sinks than tropical forests;

tropical forest hold more carbon in their living biomass / mangroves hold more carbon in the soil;
both tropical rainforest and mangroves store the highest amount of CO_2 within their living biomass for their own ecosystem category;
mangroves hold approximately 1500 metric ton carbon per hectare / tropical forest hold approx 230 metric ton carbon per hectare;
tropical forests may remove less CO_2 per unit area but occupy a far greater area globally / mangroves remove more CO_2 per unit area but occupy less area globally; **[2 max]**

Accept quantification without units.

11. (a)

identify problem [1]	**its corresponding effect on marine ecosystems [1]**
removal of mangroves results in loss of habitat/nursery area for young fish;	...reducing biodiversity/secondary productivity in coastal area; ...making species prone to extinction;
increase in soil/coastal erosion leading to more sediment entering the Coral Triangle;	…this blocks sunlight that coral/sea grasses/algae require;
loss of carbon sink that can lead to increase in global temperatures;	…increase in water temperatures can stress coral/reduce biodiversity;
increased carbon dioxide released into the atmosphere that contributes to ocean acidification/lowers pH;	...this adversely affects some species *eg* fish / reduces biodiversity; ...damages calcifying species/shellfish/corals;
without trees, runoff is no longer filtered and nutrients absorbed, thereby increasing nutrient loading within the marine ecosystem;	…this leads to eutrophication; ...this leads to algal blooms that can harm other species/reduce light to corals/seagrasses/algae; ...this leads to algal blooms that can lead to lower oxygen levels in the water (hypoxia/anoxic conditions);
removal of trees reduces water retention and increases risk of floods (overflow of freshwater) into the coastal/marine environment;	...the sudden high velocity of water could physically damage some species; ...sudden change in water salinity may kill some species;

[2 max]

*Award **[1]** for identifying the problem, and **[1]** for explaining its effect on marine ecosystems.*

Do not accept just "soil/coastal erosion" without link to increased sedimentation.

(b)

identify problem [1]	**its corresponding effect on marine ecosystems [1]**
increase in nutrient/fertilizer/nitrate/phosphate pollution;	…this leads to eutrophication; ...this leads to algal blooms that can harm other species/reduce light to corals/seagrasses/algae; ...this leads to algal blooms that can lead to lower oxygen levels in the water (hypoxia/anoxic conditions);
increase in pesticide pollution;	…can harm/kill (non-target) organisms within the Coral Triangle;
increase in pollution from animal waste/manure/organic matter;	…that can block sunlight required by corals/seagrasses/algae; …lower oxygen levels in the water;
overgrazing can increase soil erosion resulting in increased sedimentation in the reef/coastal environment;	…that can block sunlight required by corals/seagrasses/algae

[2 max]

*Award **[1]** for identifying the problem, and **[1]** for explaining its effect on marine ecosystems.*

Do not accept loss of mangroves and its associated effects.

Do not accept just "overgrazing causes soil erosion" without link to increased sedimentation.

12. reduce/restrict tourist numbers/boat numbers / use daily quotas for visitor numbers;
ban littering/waste disposal in the threatened areas / develop recycling programs for plastic waste / fine tourist for littering;
ban individual collection of souvenirs/shells/corals/fish / ban and police trade in threatened species / enforce CITES regulations on protected coral species;
restrict boat speed to reduce damage to wildlife;
restrict areas (spatially/temporally) used for boating/by tourists (tourism zones);
ban diving/snorkelling without qualified guide who ensures appropriate behaviour that limits damage to the coral reef;
anchor boats in designated areas/area fitted with a mooring buoy / restrict number of boats allowed to anchor in designated areas;
develop non-intrusive interaction with marine life *eg* glass bottom of boat to view marine life / apply restrictions on following distances for whales/marine species;
conduct education awareness programmes/advertising to educate tourists on appropriate way to interact with wildlife/coral ecosystems;
build/invest in sewage treatment systems (to reduce BOD and suspended solids of effluent released into coastal environment); **[2 max]**

Accept other reasonable responses.

Do not accept only "ban diving/snorkelling / use MPAs/LMMAS/no-take zones / legislation that prohibits any damage to coral reefs".

13. engages the local community that directly impacts the systems / can more effectively raise local awareness/encourage change in behaviour / encourages more people to be involved / provides "ownership" to locals to engender responsibility / managed by communities that cares about the project/want to help;
can be more flexible responding to specific threats/crises/local conditions;
locals are knowledgeable about the area;
can be less bureaucratic / allow for faster response / allows closer monitoring;
will provide more efficient policing / enforce policies in a way that fits the local custom; **[2 max]**

Do not accept "no take zones / tourism zones / use of traditional fishing methods / increase in fish size/fish numbers/biodiversity / employment".

14. use of education/media/raising awareness to influence consumers' values/tastes (to reduce demand);
ban on trade in wildlife parts (increasing their protection/making them less available);
establishment of reserves where shark fishing is banned (increasing their protection/reducing their availability);
greater/more efficient policing of poaching in reserve areas;
growing demand in shark tourism means sharks are worth more alive to local communities;

Do not accept only "efforts to reduce trade in shark fins" without how this is being achieved (eg education/legislation/bans).

Do not accept "less sharks are captured" without explaining why (eg reserves that ban shark fishing).

Do not accept "tariffs on shark fin imports".

Do not accept only "fishing is limited/restricted / CTI-CFF agreement" . **[1 max]**

15. *Merits – **[4 max]**:*

MPAs are supported by legislation and associated enforcement powers;
MPA could provide nursery/breeding ground for species /sanctuary for some species/ protect species from human activities / MPAs stop reduction in fish stocks through fishing activities / by restricting tourism to certain areas MPAs can reduce damage caused by tourism to reef ecosystems;
…this could allow recovery of threatened species/range of species/ biodiversity;
MPA would lead to increase in population of species that could provide food;
MPA would lead to increase in population of species that could provide an income avenue for local people/sustainable livelihood;
species from MPA could move/migrate and allow for increase in biodiversity in surrounding areas;
increase in regional biodiversity could lead to increase in ecotourism that provides an alternative income for local communities;
improvements in marine ecosystems/increase in mangroves/seagrasses can enhance carbon dioxide sequestered from the atmosphere / improvements in mangroves/seagrasses can increase carbon storage, contributing to the mitigation of climate change;
within MPAs the increase in mangroves/seagrasses/coral filters the water and removes pollutants in the marine environment;
MPAs help to meet our moral/ethical obligation to conserve/protect species / MPAs help to meet our duty to conserve our environment for future generations;
improvements in coastal ecosystems can help to protect coastal communities from extreme storm events/coastal flooding;
increase in mangroves/seagrasses population can improve water quality for other primary producers/coral reefs;
MPA creates jobs for local people and an alternative income;
MPAs allow some restricted fishing to meet the needs of local people;

*Limitations – **[4 max]**:*

establishing MPAs could cause areas surrounding them to be over-exploited / many areas still adversely affected by fishing/human activities;
difficult to stop people fishing/using areas that have been traditionally used;
difficult to stop illegal fishing by non-local vessels;
without effective policing/enforcement is unlikely to work;
some species population may have fallen below recovery levels;
MPAs can in the short-term lead to loss of income/resources / maybe difficult to find alternative income/food source in the short term for local people;
in the short-term local communities may require support to consider other ways to earn money/obtain food / loss/reduction in shark fin trade results in loss of income for fishers;
local community needs to be educated on value of MPAs;
local community needs to be educated/trained on how to sustainably fish stocks outside the MPAs;
as MPAs are managed by government (not local community) there may be a lot of bureaucracy involved and management of MPA may be inefficient / may take time to reach a consensus before action can be implemented / corruption may be an issue leading to inefficient management of MPA;
difficult to manage/balance interests of so many stakeholders (ie six countries, local governments, NGOs etc.);
predicted loss of coral by 2050 is a result of global warming, which will not be stopped by protecting local areas;
with increase in tourism there may be increased pollution caused by waste/plastics resulting in decrease in biodiversity;
with population growth in the area and associated increase in food demand the restriction in fishing within MPAs will cause human hardship;

*Award **[5 max]** for merits and limitations.*

*Conclusion/opinion **[1 max]***
For example: over the long term MPAs can be effective at improving biodiversity/state of the ecosystem and sustainable resources for local people although in the short term they can pose many difficulties/hardships for local communities (without appropriate support);

A valid conclusion should be credited if it is explicit, balanced (addresses both sides of the argument) and supported by evidence. Do not credit the conclusion if only one side of the argument has been considered within the overall response.

[6 max]

Accept other reasonable responses supported by information in the resource booklet.