Environmental systems & societies SL

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Grade boundaries

Standard level overall

Grade:	1	2	3	4	5	6	7
Mark range:	0-11	12-22	23-35	36-45	46-56	57-66	67-100

Standard level internal assessment

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-8	9-13	14-16	17-20	21-23	24-30

Standard level paper one

Grade:	1	2	3	4	5	6	7
Mark range:	0-5	6-10	11-15	16-18	19-22	23-25	26-35

Standard level paper two

Grade:	1	2	3	4	5	6	7
Mark range:	0-5	6-11	12-17	18-24	25-31	32-38	39-65

Standard level internal assessment

The range and suitability of the work submitted

Most of the submitted work was suitable with investigations ranging from group 4 type scientific investigations to group 3 research-based investigations using surveys and questionnaires. Generally, a good range of topics were covered, which were extensions of the topics covered in the syllabus.

This session, more candidates carried out either secondary data research or used questionnaires/surveys to collect data. These methods don't always gather sufficient data or may lead to biased data that is challenging to use effectively in a report. Some reports were based on unsuitable work such as literature search and discussion.

Many of the poor IAs were based on questionnaires/surveys; some were too nebulous and vague to enable the students to produce a good report. A common weakness is a frail connection between the research question and the environmental issue. At times, the relationship between the research question and the environmental issue is not realistic. Teachers should be reminded that an applicable environmental issue should be the driver for the student investigation. The environmental issue is commonly very large and the stated research question is far too broad for the level of the investigation, or very focused with no link between the environmental issue and the research question.

Candidate performance against each criterion

Criterion A: Identifying the context (CXT)

Developing a good relevant RQ that is focused and coherent is very difficult to achieve and rarely seen (most RQs are relevant). RQ can be poorly focused but relevant, creating a marking conflict. EI is generally well done whereas the connection to the RQ is not and may be a jump in one sentence to the investigation itself. The link between the RQ and the environmental issue commonly lacks justification for the of the scope/plan of the investigation. The teachers mostly noted when the students had serious misconceptions and/or errors in their EI or RQ.

Criterion B: Planning (PLA)

Generally, candidates are reporting sufficient detail to replicate the investigation, however, the justification of sampling strategy is often overlooked or poorly represented in the report. This was also true last year. There seems to a be trend of giving very short procedures and then longer paragraphs trying to justify the choices for the method. This approach does not give enough detail for the repeatability of the investigation. The risk and ethical considerations aspect was often either not attempted (not even mentioned if using secondary data) or poorly attempted (lacked depth). Some methods were stated as having no risks which was plainly not true. The planning section, in general, shows internal consistency within the moderation sample for schools. Students found the plans for fieldwork, secondary data and surveys the most challenging to write well. These plans often lacked sampling strategies and sample collection information. The justification for the choices of

variables is the most common missing element, or is only mentioned superficially. There were a number of students, and sometimes a whole sample, where the Context and RQ stated did not match the investigation planned.

Criterion C: Results, analysis and conclusion (RAC)

This criterion is still very variable in the presentation format and the expectations from the teachers. The inconsistencies seem to result from teachers applying with other subject IA criteria to ESS, for example students included raw data in an appendix, comments about uncertainty and often an analysis was not included. Most students did some processing of the raw data to allow patterns and trends to be identified. The range of statistical applications is growing, though tests are not always applied to appropriate data sets. Stronger investigations commented upon the patterns/trends and then considered reliability, usually with standard deviation or a correlation coefficient. Some students, and some schools, present graphs for the analysis but do not comment on their relevance to the RQ. The conclusion, when clearly completed, was generally drawn from the presented data. Conclusions should be concise and to the point; however, commonly this was not so, and it included a mixture of EI and DEV thrown in for good measure.

Criterion D: Discussion and evaluation (DEV)

The discussion section is missed out in many reports, or combined with the conclusion and/or analysis. Students consistently either missed or glossed over the aspect of discussion between the conclusion and environmental issue. Stronger reports are those that link the conclusion back to the EI. The discussion section is a good discriminator for the quality of the overall report. Most candidates can at least state some weaknesses and improvements, although most do not give enough discussion on their potential impacts on the investigation and oftentimes evaluation is superficial. Weaknesses that undermine the validity of the investigation (e.g. assumptions, design) are always more significant than random errors or human errors, but most concentrate on the latter two error types. Many candidates do not include any suggestion of further research, or include only very superficial ones.

Criterion E: Applications (APP)

Most candidates included some form of application/solution, but often its evaluation is superficial or not attempted. Many applications are not described with sufficient detail, and some are too general and not strongly linked to the investigation and EI. Several candidates list a variety of solutions rather than focusing on one. Many reports suggested a solution to the environmental issue under consideration, but did not base it on the investigation carried out.

Criterion F: Communication (COM)

Most reports are properly structured and well-presented. Some students indicate a report of over 2250 words, the moderator stops reading once the 2250 words are reached. The clarity of the data presented still needs improvement, in the tables, figures and graphs presented. Some students and schools do not use SI units and this is not appropriate. There are still a minority of students who use an appendix for data and figures.

Recommendations and guidance for the teaching of future candidates

The 20 hours for the practical element of the course should give the students the opportunity to learn the techniques for the different types of IA investigations: labs, field work, secondary data, surveys etc. The teachers must provide feedback to the students on a draft and then provide marking guidance for the moderator on the final report. Many of the comments made were very brief and did not allow the moderator to see how or why a mark was or was not awarded for a criterion. Reports that had detailed comments on the work or added as part of the mark entry really helped the moderation process.

Please encourage the student to have a personal connection to the EI as this makes the engagement and the data collected more authentic and the student finds the process easier to complete.

Please use the exemplars from the TSM and use the "programme communities" section of MyIB to ask questions and seek guidance.

CXT: Although some students were writing about a broader environmental issue, their research question was not as focused as it could be. For the higher marks in this criterion the student needs to be able to justify the connection between their own study and the bigger problem that was the stimulus for their investigation. If they do want to consider a global issue it should be linked to a local context – which then creates the RQ.

Students need to have guidance on how to write a focused RQ, and to make sure that the investigation will be manageable and has the potential to address all the criteria within the word count.

PLA: The procedure needs to be repeatable and as such must contain enough detail, and will often contain diagrams/maps. Different types of investigation will lead to different types of plans. The students should be familiar with how to design fieldwork – looking at sampling techniques, site choices, collection details of the sample and collecting sufficient and appropriate data to answer the RQ. For example noting temperature on one day in the field is not worth much unless it is supplemented by secondary temperature data. When designing surveys/questionnaires, consider what type of questions should be asked, how the data will be collected, how to minimise bias in collecting the surveys, how many of each group to ask?

With secondary data investigations, students need to be aware of how to mine databases, what are reliable databases, how to obtain similar data from different sources, how much secondary data is needed. Specific teaching of how planning decisions can be justified in the methodology are required. All investigations must have a section for safety/risks/ethical considerations.

RAC: Candidates should be encouraged to manipulate/process the data to show patterns and trends that answer the RQ. There must be evidence of data processing and the method used to process the data should be easy to follow. Processed data may be included in the same table as the raw data. An appropriate graph or diagram must be included in the report. Candidates should be advised not to copy and paste tables and graphs from the internet into their reports but rather find a way to synthesize their own tables/graphs. The statistical tests applied to survey data and secondary data should be appropriate for the data set. The consideration of the reliability of the results should

appear in the analysis. Teaching the types of graphs that are suitable for different data sets should be incorporated into the class and practical activities.

DEV: The discussion must link back to the EI, and use the conclusion. Having science theory or literature review information/data can really strengthen this section. The evaluation section requires several elements, including the main strengths and weaknesses of the method and how the investigation was carried out. Suggestions for further research to extend the perspective of the original idea should be included. Students need to practice how to include all of this in relatively few words.

APP: One solution is required that considers the conclusion from the data and links to the EI. This section should include relevant strengths, weaknesses and limitations of the solution proposed. A specific solution is usually easier to evaluate than a general one.

COM: The vocabulary should be subject-specific and subject-specific conventions are expected, such as using SI units. Writing concisely is also a skill which should be practised. Sweeping generalisations and emotive language or bias should be avoided in the writing of the report. All figures, tables, graphs etc. should be correctly labelled with titles, headings and units. Any figures used from other sources must have citations and be recorded in the bibliography. The report must be within the word count.

Further comments:

Students could be encouraged to identify local environmental issues. This will help them to relate better to the problems and their investigation will be more meaningful.

Teachers should include comments to explain why a mark was or was not awarded for a criterion as this helps the moderation process.

Exposure to a variety of practical experiences before students attempt their IA investigations will enable students to make good choices for the type of investigations they undertake.

Standard level paper one

General comments

The number of candidates increased by 6.37% from 13834 candidates in May 2018 to 14715 candidates in May 2019. There were 159 new schools which comprised of 1530 candidates (10.4% of the cohort). The number of candidates taking the paper in French fell from 46 in May 2018 to 26 in May 2019, although for Spanish there was an increase from 645 to 766 for the same period.

The majority of teachers' comments were positive with the general opinion that the paper was of appropriate difficulty and similar standard to that of previous years. 85% considered the clarity of wording to be good, very good or excellent. Typical teacher comments included:

"Resource booklet case study was excellent. Descriptions well presented."

"This year's paper is much clearer. The diagrams and graphs are more straightforward to understand."

"The questions are clear enough with appropriate standard."

A few teachers felt the students needed more time for this paper to enable them to read the resource booklet and fully answer the questions.

The areas of the programme and examination which appeared difficult for the candidates

Some candidates misunderstood the command terms, e.g. 'explain' was often interpreted as describe or 'to what extent' interpreted as to consider only the merits without including any counter-arguments or a balanced conclusion.

Many responses lacked the detail necessary for credit due to the use of generic rather than more specific terms. Candidates need to name the specific type of pollutant/chemical rather than referring to 'pollution/pollutants' or specify the actual change that occurs to an ecosystem/organism rather than using terms such as 'influences/impacts/changes'.

Although candidates were often able to identify key points from the resource booklet, some struggled to place this into the wider context of their knowledge from different parts of the ESS syllabus. For example, most candidates were able to identify water quality aspects changed by mangroves from the booklet but were then unable to give the associated effect of each factor on primary producers. Candidates often struggled with the application of their knowledge and in linking topics across the ESS syllabus.

Specific aspects included:

- Understanding the reasons for the differences between age-gender pyramids for different countries.
- Knowledge of the advantages of harvesting food from different systems e.g. a marine system and terrestrial agriculture.

- Linking human activity in one area to resultant impacts in another area e.g. activities on land that lead to adverse impacts in the marine environment.
- Understanding the advantages of community-based projects such as Locally Managed Marine Areas (LMMAs).
- Knowledge of how different abiotic factors can affect water quality and therefore the growing environment for primary producers.
- Understanding changes that occur due to climate change which in turn impact ecosystems (e.g. increase in seawater temperature, ocean acidification, sea-level rise and increase in precipitation).

The areas of the programme and examination in which candidates appeared well prepared

The majority of candidates were able to identify and appropriately use information from the resource booklet.

Specific aspects included:

- Interpreting data from figures provided.
- Calculating percentages using data from the resource booklet.
- Understanding food webs and the dynamic nature of feeding relationships.
- Understanding and interpreting data relating to mitigation of climate change.
- Conservation strategies used to reduce threats to biodiversity from tourists.
- Conservation strategies used to reduce either availability or demand of endangered species.
- Understanding the benefits of using Protected Areas (e.g. Marine Protected Areas).

The strengths and weaknesses of the candidates in the treatment of individual questions

Question 1

The majority of candidates correctly answered the question. The most common incorrect response was Indonesia.

Question 2

Few candidates achieved full marks for this question. Many responses only gave a description of the age-gender pyramid or focused on birth rate and death rate without giving specific reasons for the differences observed. Some responses only stated the reasons but did not outline the actual differences between the pyramids.

Question 3

The majority of candidates calculated percentage correctly. A few rounded the answer incorrectly and there appeared to be some candidates who did not have a calculator and struggled with the calculation.

Question 4

Most candidates only achieved one out of two marks by recognising that fish diversity would be high when habitat diversity is high. Very few candidates were able to provide a reason for this.

Question 5

This question was answered well by most candidates. Common errors included: (i) only stating changes in feeding behaviour but not how this affects the population numbers; (ii) misinterpreting the direction of the errors.

Question 6

(a) The responses for this question were very mixed with popular responses including 'diverse range of species/food available' and 'high in nutrients/protein'.

(b) Overall, this question was poorly answered. A significant number of candidates did not attempt to answer it. A few candidates confused aquaculture with agriculture. Few students stated that production is more efficient as food is harvested from a lower trophic level (less loss of energy).

Question 7

Most candidates achieved some marks for this question. Many responses included the explanation but not the corresponding effects for example, they recognised mangroves trapped sediments but did not link this to water clarity, light penetration and improved photosynthesis for primary producers. Some candidates did not recognise the question was asking about producers, which do not require additional oxygen from mangroves to survive.

Question 8

Few candidates achieved 2 marks, most responses only considered one way in which a loss of coral reef would impact a seagrass community. A common error was to discuss the role of coral reef but not what would happen to seagrass in the absence of coral reefs. Some candidates incorrectly stated that the organisms from the coral reef would simply relocate to the seagrass ecosystem.

Question 9

There were some excellent responses. Some responses lacked the detail necessary, e.g. referring to climate change in general or to changes in either water pH or temperature without reference to direction of change. A few responses incorrectly suggested a decrease in global temperatures and associated colder climate.

Question 10

This question was fairly well answered by most candidates who were able to successfully interpret the data given.

Question 11

(a) Few candidates achieved full marks for this question. Many struggled to link deforestation on land with an impact on marine ecosystems. Common error was to use generic terms such as 'pollution' and not name the specific type of pollutant.

(b) This question better answered than Q11a. Many candidates correctly identified fertilizer runoff as causing problems of eutrophication. Common error was to discuss the removal of mangroves rather than focusing specifically on agricultural activity.

Question 12

This question was well answered by the majority of candidates. Some responses lacked the necessary detail for credit, e.g. they stated 'reduce pollution' without specifying type of pollution and how it could be reduced.

Question 13

Many candidates incorrectly answered this question often referring to key features of Marine Protected Areas rather than focusing on what is unique to and therefore an advantage of Locally Managed Marine Areas.

Question 14

Many candidates gave good focused responses. Common error was to give vague statements such as 'efforts to reduce trade in shark fins' without suggesting how it was being achieved (e.g. via legislation that banned trade).

Question 15

Most candidates achieved some marks for this question, with many obtaining between 2 to 4 marks. Common error was to discuss only the merits of using MPAs and not include any limitations. In addition, few accounts gave a balanced conclusion that addressed both sides of the argument.

Recommendations and guidance for the teaching of future candidates

- Encourage students to read the question carefully and thoroughly. Students should practice reading more exam style questions and how to answer the question directly.
- Ensure the meaning of each command term is fully understood. Candidates should know which command term requires them to include counter arguments and a clear conclusion/appraisal.
- Ensure students know how to write a balanced conclusion.
- Encourage students to consider the number of marks that are awarded to a question and ensure that enough information has been included to earn full marks (e.g. reasons, impacts, limitations or examples).
- Encourage students to give focused answers to questions using appropriate ESS terminology. They should avoid using generalised words or phrases such as "pollution", "emissions", "affected by" as these are too vague for credit. Responses need to be specific, for example, if pollution is being emitted, what kind of pollution and what is its impact.

- Students should be encouraged to take care with their writing during the exam to ensure that it is clearly legible. Only dark ink should be used as scripts will be scanned and marked on-screen.
- Candidates should be encouraged to keep their answers within the answer box. If extra space is required, then they should continue the response on additional pages.
- Encourage students to practice past papers, answering different command terms, extracting information from data tables, charts and graphs.
- Ensure the whole syllabus is covered in sufficient detail. This includes ensuring students have knowledge and understanding of:
    - age-gender pyramids.
    - food production from both terrestrial and aquatic ecosystems.
    - abiotic factors within aquatic systems and associated effects on primary producers.
    - advantages of community based conservation projects.
    - various aspects altered by climate change and associated impacts on marine ecosystems.
    - the holistic and inter-connective nature of ESS, e.g. how changes in one ecosystem could lead to knock-on effects on another ecosystems.

Standard level paper two

General comments

The cohort was of very similar composition to the previous May session and the performance on Paper 2 was only minimally higher than before, suggesting a consistent level of difficulty and challenge. Generally, the G2s suggest that clarity and presentation of the paper were considered very good. There were no issues clearly arising from the Section A questions and diagrams were complimented for their clarity and appropriateness.

Some G2 comments appeared to be founded upon the mistaken assumption that responses to Section B questions (including parts a, b and c) are expected to be given as a single amalgamated essay …a practice actually adopted by a minority of candidates. This is not stated or intended in the exam rubric (and never has been, even in previous incarnations of the ESS programme). While examiners will do their best to extract all points of merit from such responses, the actual expectation is that each part (a-c) will be addressed with its own stand-alone response, and it is very likely to benefit candidates that present their responses in such a format.

One or two G2 comments also criticised the tendency of the Section B part c questions for bringing together very different topics from the syllabus in combinations in which they have not necessarily been taught. In fact, these questions, as outlined in the guide, are designed with just that purpose in mind and are likely to be of a similar quality to the Big Questions listed in the full subject guide.

The areas of the programme and examination which appeared difficult for the candidates

In terms of syllabus content, areas of this paper in which candidates showed less confidence and/or accuracy were: negative and positive feedback, distinction of tropospheric versus stratospheric ozone issues, primary versus secondary succession, details of practical measurement procedures and parameters associated with carrying capacity.

With regard to addressing the examination questions, the specific challenge of producing responses that were both sufficient and apposite was the most frequent cause of under achievement. The lack of sufficiency was most prominent in Section B part b questions where 7 marks were available for suitable responses and many candidates would satisfy themselves with far fewer potential answers or details. Section B part c questions, with their relatively extensive breadth, were where the lack of fully relevant responses was most prominently revealed. These questions also prove the most challenging in that they depend more heavily, not simply on relevant knowledge statements, but the balanced organisation of such statements into an analytical argument and conclusion.

The areas of the programme and examination in which candidates appeared well prepared

Candidates generally did well identifying, describing and explaining data from models, discussing issues of waste management, explaining impacts and processes in ecosystems, describing population growth, appreciating factors affecting ecological footprints, identifying mitigation/adaptation strategies for global warming.

Despite the greater challenges of the Section B part c questions, overall, candidates were showing an improved approach to them, often making a clear attempt to address two sides of an argument and including a conclusion.

The strengths and weaknesses of the candidates in the treatment of individual questions

Section A: Generally, candidates were able to make a significant attempt at answering most of this section but a great number satisfied themselves with just one factor in response to those parts offering two or more marks and so failed to gain the full available credit.

Question 1

(a) Most were able to give one relevant feature of r strategists.

(b) Most were able to give one feature of a climax community contributing to its stability.

(c) Probably around half the candidates were sufficiently familiar with both concepts to clearly distinguish zonation from succession.

(d) Most were able to give one way in which food webs change.

(e) Many candidates failed to appreciate this was an example of secondary succession and hence, although organic matter may be low in pioneer soils, mineral content would be high.

Question 2

(a) Vast majority gained credit for this with just the occasional erroneous response of "Australia".

(b) Many correctly suggested more available land in US but quite a few suggested greater quantity of waste/population which wouldn't in itself explain the greater **percentage** use of landfills.

(c) Most were able to suggest one strategy for reducing impact of landfills.

(d) Most were able to identify disadvantages of either 'waste to energy' or 'recycling/composting'.

Question 3

(a) Most were able to extract and calculate data with sufficient accuracy.

(b) Many were able to suggest two factors though a good number forgot sunlight/UV. There were also some confused responses suggesting CFCs/refrigerants.

(c) Mostly correct, with occasional confusion of stratospheric/tropospheric ozone.

(d) There were a good number of candidates mistakenly addressing stratospheric ozone issues, i.e. CFCs/ODSs/Montreal Protocol etc. Those that were on the right track frequently scored 2 or 3 of the available marks, though rarely all 4.

Section B: Q4c was identified on G2s as posing the greatest difficulty to candidates and certainly Q4 was the least popular choice, but actually candidates tended to score more highly on parts a and b of this question, such that the four optional questions in Section B seemed to provide quite a balanced challenge overall.

Question 4

(a)(i) Most candidates were able to identify two transformations of matter.

(a)(ii) Few candidates were able to identify transfers of energy in the atmosphere …often referring instead to energy transfers in food chains or transfers of matter.

(b) Most candidates were able to gain three or four marks through addressing precipitation in rainforests and deserts, but few went further than this.

(c) Responses often addressed **either** impact of climate on agriculture **or** vice versa, limiting range and balance of argument. A good number also addressed sustainable agricultural practices quite unrelated to climate.

Question 5

(a) Great majority scored some credit, usually for addressing depletion of plants and outcompeting other herbivores … but few went on to consider further impacts of these phenomena and so were limited to two marks.

(b) Many candidates scored some credit here, though usually rather precariously through identifying some limiting factor or describing predator–prey relationships, but rarely with a sound understanding of the role of positive and negative feedback in population growth curves.

(c) Many candidates could identify ways in which medical/agricultural technology are significant in overcoming limits to growth during early development but few acknowledged opposing influences later on, or related their response very directly to all stages of the DTM.

Question 6

(a) Many candidates were able to identify appropriate strategies to reduce impacts without reducing the use of fossil fuels although these were often mixed with inappropriate strategies that **did** imply reduced use of the fuels.

(b) Responses often failed to score well because they just listed factors that could be measured or described how they might be affected, but gave minimal or no practical details of **how** they could be measured.

(c) Many candidates approached this question well, discussing difficulties with alternative fuels and economic and political pressures for the continued use of fossil fuels. Weaker responses had few relevant and specific examples and a limited range of different reasons for the paradox.

Question 7

(a) Many candidates gained a mark or two here for mentioning diversity in lifestyles or technological developments but many responses were too vague or addressed irrelevancies of population demographics.

(b) Most candidates were able to identify differences in diet and energy sources but few were able to identify other factors affecting ecological footprints. Some addressed irrelevancies of population sizes.

(c) Responses tended to show either some understanding of principles of design for protected areas or of principles for sustainable harvesting, but rarely both.

Recommendations and guidance for the teaching of future candidates

Much key advice remains constant from year to year. For example, candidates should be encouraged to take careful notice of the number of marks available for each question part to give an idea of just how many knowledge statements are being expected. They should also be encouraged to underline the key command terms and specific requirements of the questions and to research and learn detailed and specific examples and case studies for use in the exam.

Approach to the Section B part c questions has improved, but this is still a key area in which student performance could be improved with practice and simple strategy. Candidates need to identify clearly the full scope of the question, brainstorm for as many potentially relevant knowledge statements and examples as they can, and organise them into a linear argument/counterargument with a conclusion that directly relates to the wording of the question.

Increasing attention to those areas of the programme identified above that proved more difficult would naturally be of benefit … particularly addressing the confusions that still persist around global warming, tropospheric and stratospheric ozone.