May 2013 subject reports

Environmental systems and societies

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 16	17 - 32	33 - 44	45 - 55	56 - 66	67 - 77	78 - 100

Standard Level Internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 42

Recommendations for IB procedures, instructions and forms

Schools should ensure that they are using the correct ES&S/PSOW form and not the Group 4 PSOW one as the evaluation criteria are different. The electronic form seems to be helpful although a few schools ticked practicals and then did not include the levels for the criteria to be assessed. Ideally all levels awarded throughout the course should be included and not just the two that are being moderated.

Please ensure that instructions are included along with the samples. This is vital for the assessment of the portfolio. Moreover, schools will be asked to submit these instructions and obviously this is a bother for all involved. It is frustrating to see the relevant item checked off on the IA form and then not find the instructions.

Please ensure that all topics are included on the PSOW.

Moderators report that some practicals seem to take an unreasonable amount of time. Group discussions of the work, library research time and time at home, should not be counted as hours of IA work.

The range and suitability of the work submitted

The May 2013 IA moderation exercise did not see major departures from previously identified problems. Most of the work is suitable for the assessment of the IA criteria, although there are

plenty of problems in the assessment of the same. These will be addressed in the sections below.

There is a wide range in terms of the resources available to schools (or at least being used by students). Some schools are able to use digital probes for field work others show no evidence of ICT at all. As technology is such an important part of our daily lives, its use in practical work really should be implemented wherever possible if for no other reason than to show students the limitations of such equipment. All too often students seem to think that a digital read out can have no error, which is of course, not the case.

Generally speaking, the topics with least representation tend to be topics 4, 5, 6, and 7, and of these topic 6 is probably the most often left out.

The current course has seen an increase in survey work, especially those centered around environmental views. However some moderators note that the data generated and its analysis is not very robust. Students may need some direct instruction regarding the formulation of a survey. For example it is often best to ensure that in a question that has numerical answers, that the choices be an even number. Faced with an odd number of choices, often responders will choose a middle value which does not provide a lot of information. Additionally, students should be taught how to interpret their results. For example in a survey with four choices, ranging from “strongly disagree” to” strongly agree”, grouping all the “agrees” together with the “strongly agree” may provide a clearer picture than the two of them separately. Students should be taught how to formulate questions that do not “lead” the responder. In addition many of these studies work with samples that are too small for good analysis.

Some moderators called for more complex practicals, and many showed concern about the low level of data processing. A number of schools show only two evaluations scored against the criteria. If students are assessed only twice in two years, it will be difficult to show growth or improvement, or to provide feedback so that they may improve

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

Planning: Many schools are doing this well. However a few schools have problems with the formulation of a proper research question or topic. Weaker candidates continue to have problems with clear separation of Dependent and Independent variables. As has been stated previously this should be taught specifically, perhaps in conjunction with mathematics. Some schools have gone to tables and obviously this helps students, especially those who tend to forget to include all the necessary information.

Students are losing marks in aspect two due to insufficient information regarding how their samples are chosen or how transects are selected. Previous subject reports have mentioned this problem but it persists. In a field study, it is hard for students to demonstrate the concept of a control or a fair, unbiased test. This is important because it allows the reader to determine if the student has done a good enough job of controlling biased sampling. Moreover in a field study it may be the only part of the design that the student really controls. Clearly they have not developed quadrats or transects on their own, but how the site was sampled will largely be a student decision. Some moderators noted some improvement in this area.

Students are still losing marks for having too few data points. This should be a relatively simple task to master but the full marks awarded by teachers for practicals with too few samples, would seem to indicate that they are not aware of the requirements in this area. Five

repeats are considered a minimum for most experimental work, three transects are considered a minimum for field work. Please read previous reports for further clarification of this point.

Data collection and processing: For aspect one, some students neglected to include raw data. As students are allowed to submit a first draft of their work, it is odd that this doesn't get picked up. Clearly when there are data analysed, the lack of raw data is an omission. The problems in raw data recording are the same every year. A raw data table needs an explanatory title, properly labelled row and column headings with the appropriate units. The use of decimal places, significant figures must be consistent Although uncertainties are desirable, they continue to be a matter of choice.

Too many schools are missing opportunities for rich, meaningful analysis of data. Unfortunately this has not resulted in lowered marks, and so candidates don't have the feedback they need. For example, if a student calculates averages for two sets of eight data points, the standard deviations for these data sets should be included. To not do so, may result in a drop of one mark on this aspect. Within reason, students should exhaust the analytical tools available to them. Calculations should be spot checked to verify accuracy. Moderators do spot check and routinely find serious errors.

Some teachers continue to give full marks for graphs constructed from raw rather than processed data. The graph choice is often poor and the teachers seldom comment on this. For example a pie chart when a bar chart is called for. When students graph data using a bar chart to display survey results, the bars should be ordered in some way so as to aid interpretation. Students do not always use scatter plots with lines of best fit when not doing so is so inappropriate as to warrant the loss of a mark, and teacher do not always spot this. A sampling trip down a river in which students are gathering temperature, turbidity, conductivity, pH and diversity data, should result in some scatter plots where one variable is graphed against the other. Especially if say the research question has focused on the relationship between temperature and diversity. To not do so, may result in loss of marks, because it is an obvious requirement of the data.

Discussion, Evaluation and Conclusion: Moderators report difficulty in separating discussion and conclusions in some reports. Different headings for these sections may help and certainly focus the students in terms of what is required. The discussion should focus on the quality of the data, the trends seen, and very importantly, the context of the study. Often students lose marks for providing no links to other studies, larger contexts or ecological concepts. Moderators comment that there is a tendency for students to focus too much on their own results. Discussion should show understanding of ESS concepts, which were often missing.

As has been said in prior reports, it is a rare study that cannot be improved substantially by the collection of more data, either during the study or seasonally. However, many students fail to remark on this in their evaluation. There continue to be schools where students receive full marks for evaluations that really boil down to, "we should have worked more carefully." Although this may be true, such analyses in and of themselves, will receive no marks in this aspect, but may be useful when assessing Personal Skills.

Conclusions tend to be well stated but suffer loss of marks when there is no use of the data generated in the practical. For example a study on diversity should state that the value of Simpson's index in site A was higher (5.6) than site B (4.2), and provide a possible reason or explanation. Without the numeric data supporting this statement, there is an almost automatic loss of a mark.

Recommendations and guidance for the teaching of future candidates

Planning: Some students may benefit from the use of tables for different variables. 5 treatments of the independent and 5 repeats/set ups are usually the minimum data set required. For transect studies, three per site are usually seen as the minimum. Although during the carrying out of the practical, logistic problems may reduce the data set, in the planning stage students should be working with these concepts for full marks in aspect 3.

DCP: Raw data and processed data should be placed in separate tables. Tables should have a good explanatory title and detailed row and column headings to indicate what is being shown.

DEC: Separate headings may ensure the students meet each aspect of the criterion. Limitations and weaknesses / improvements set out in a table for clarity and to ensure each error has a suggested improvement may help some students to meet all the requirements of the aspect. The discussion should stress the systems aspect of the curriculum instead of treating each activity as a reductionist piece of the whole.

Reading the individual school feedback reports would seem to be a logical first step but the repetition of these comments over the years by different moderators, seems to indicate that this is not the case. This is of course frustrating for the moderator. If a school has been severely marked down, corrective actions must be taken, and a good place to start is the OCC and the Teacher Support Material.

Paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 8	9 - 16	17 - 23	24 - 27	28 - 32	33 - 36	37 - 45

General comments

A larger proportion of G2 forms were completed by schools than in previous years, with a return of 25%. Most responses considered the level of the paper to be appropriate and on par with M12 and agreed that the presentation and clarity of the wording was appropriate or good. Opinions were split with comments such as ‘The breadth of topics covered was very good’ and ‘The paper covered most of the syllabus and was very clear to understand’ contradicting with comments such as ‘too many questions about air pollution. Although they were at the appropriate level, this topic seemed over represented on Paper 1’. The majority of respondents considered it to be a ‘fair paper’. There was concern over whether students should be expected to be familiar with logarithm scales and also over the clarity of question 3a(i) asking students to ‘state the terms used for the three classes of natural capital’. Some respondents felt this question was ambiguous and would have been difficult to understand especially for ESL students.

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

Students did not always understand the requirements of different command terms such as outline, explain, suggest and evaluate. This may have resulted in many responses lacking the necessary detail and focus, with many answers given being too general and vague. Students frequently struggled to provide clear definitions of key ESS terms. As in previous sessions there was confusion between ozone depletion, global warming and acid rain. Few students demonstrated an understanding of the concept of entropy, use of logarithm scales or knowledge of the gaseous composition of the atmosphere. Students also continue to struggle with some of the mathematical calculations (i.e. calculation of percentage natural increase rate and doubling time).

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

Overall students performed well on questions focused on factors affecting human populations, energy flow in the ecosystem, construction of a food chain and suggesting methods to prevent soil erosion. They also demonstrated good ability to interpret graphs and diagrams.

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

1a A large proportion of students appeared not to be familiar with the composition of the atmosphere and incorrectly answered this question, with responses such as hydrogen, ozone, CFCs, oxides of nitrogen and sulphur and carbon dioxide.

1b(i) The majority of students correctly answered this question.

1b(ii) Common errors included providing only one source of ODS, naming an ODS such as CFCs or suggesting incorrect sources, for example, car emissions or power stations.

1b(iii) Many students identified strengths or limitations, rather than both as required. Students need to be aware of the requirements of each command term, such as ‘evaluate’. Some students confused the Montreal protocol with the Kyoto protocol. Another common error was to repeat the stem of the question without adding anything more of value.

2a(i) A large proportion of students were unable to correctly identify both sulphuric acid and nitric acid. Incorrect answers included sulphates, nitrates, nitrous or nitrogen acid.

2a(ii) Many students struggled to clearly identify a transformation process. Many accounts were very vague and lacked specific detail or naming of an actual process. More students were successful in correctly identifying a transfer process such as the movement of water from the clouds in the atmosphere to land via precipitation.

2a(iii) Few students achieved full marks for this question. Most students appeared to be unaware that acid deposition can occur near to the source of primary pollutants and is affected by regional climate and geographical conditions. Many students repeated the stem of the question.

2b(i) Most students identified the overall trend of both pollutants and many were also able

to further quantify /describe the changes that occurred over time.

2b(ii) Students generally performed well on this question. A common error was to outline advances in technology which were not directly related to reducing transport emissions e.g. factory scrubbers.

3a(i) Many students did not correctly state renewable, non-renewable and replenishable for the different types of natural capital.

3a(ii) Although most students were able to gain credit for selection of an appropriate example, few explained how the example should only be harvested at a rate and in a manner that did not damage future supplies.

3b(i) Many of the definitions given for carrying capacity were too vague.

3b(ii) As with 3b(i), the term sustainable yield was often poorly explained.

3b(iii) The majority of students correctly answered this question, with a few omitting the required units.

3b(iv) Few students achieved a mark for this question; they struggled to identify a factor that may cause changes in the yield.

3c Most students answered this question well. Popular responses included replanting and terracing.

4a(i) The majority of students achieved full marks here. Common mistakes included drawing food webs, pyramids, incorrect direction of arrows or naming organisms not found on figure 6.

4a(ii) Most students correctly responded to this question, although a common error was to state that all predators of snakes were removed/snakes had no predators left.

4b Few students achieved full marks here. Some students identified water limiting primary production in a desert but the vast majority of answers were very vague or incomplete and failed to link differences in primary production to the knock on effects on trophic levels or habitat and niche diversity.

5a(i)-(iii) Most students achieved all 3 marks for this component.

5b Many students only stated the transfer rule but did not always suggest how energy is lost along the food chain.

5c Most students appear to have little understanding of what entropy is and its relationship to heat loss along the food chain. Many answers either explained the second law of thermodynamics or were vague and incomplete.

6a(i) Very few students could identify log/logarithmic scale. Incorrect responses included number of survivors, arithmetic, geometric and exponential scale.

6a(ii) Most students achieved one or two marks here and were aware that K-strategist have longer life spans, same as species A. Marks were sometimes lost for lack of clarity especially regards to species A having fewer deaths at a young age or for discussing characteristics of K-strategists or r-strategist which could not be inferred from the graph.

6b(i) Most students answered this question well with prey/predation/disease being popular chosen factors for the selected named animal. Marks were sometimes lost for omitting one component of the answer e.g. named animal.

6b(ii) Marks varied widely for this question with some very good and detailed answers. Sometimes marks were lost for not appropriately labelling the axis on the graph or not giving reasons for the population increasing or decreasing.

7a(i) Only about half of students correctly calculated the percentage natural increase rate.

7a(ii) More students struggled with this calculation than 7a(i); with an increasing proportion of students making no attempt at the question and leaving a blank space.

7b Most students achieved full marks and demonstrated strong understanding of human population dynamics.

7c The majority of students correctly responded to this question. A frequent error was to confuse GHGs with ODS such as CFCs.

Recommendations and guidance for the teaching of future candidates

Students should be encouraged to: read the exam question carefully and ensure they address the specific command term and actual question being asked. Attempt all components of the exam questions and not leave any blank responses. Make and appreciate the inter-connections between each ESS topic. Practice past question papers and other questions that involve application of knowledge and understanding to different situations, including mathematical calculations. In addition, students should ensure they are familiar with the key terms and concepts listed within the glossary of the ESS Guide.

Paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 9	10 - 19	20 - 25	26 - 33	34 - 40	41 - 48	49 - 65

General comments

The G2 form was completed by 21% of the schools who entered candidates for the M13 session. The comments made by the teachers were helpful in understanding how the candidates and the teachers view the exam. 90% felt the level of the exam was appropriate with 57% maintaining it was a similar standard to 2012 and 8% feeling it was a little easier and 26% more difficult. Clarity of wording and presentation were also deemed good by the majority of respondents. The opinions on the case study and resource booklet were mixed. Comments on question 1 are in the section on the treatment of individual questions. Some of the G2 comments are below:

“A thorough and in-depth understanding of important concepts was required to answer the paper”,

“Different to past papers with no country / biome case study but rather issue based”, “Many of the questions for section A did not require information from the resource booklet”, “The questions from resource booklet was really challenging. The answers were not direct. In fact candidates had to put into practice application of concepts taught with reference to the resource booklet”, “I liked the case study using the Pacific Ocean as the theme. The case study provided for varied and interesting questions that were at all levels of difficulty”, “the Resource booklet appeared very disjointed without the normal obvious overarching theme. I guess ‘Pacific and South America’ would be a theme if I had to find one; but that is really extremely broad”, “This case study does a very nice job of integrating earth, life and physical science”, “Honestly you don't need the course to answer these questions. This does not represent rigorous standards”.

The essay section was generally received positively by the candidates and teachers. “The extended response questions were very fair and achievable for candidates”, “some essay questions were too big”, “I found the essay questions to be much easier to understand - candidates were not confused about how to answer questions”, “P2 was fair and the questions gave a good chance to a well revised candidate to do well”, “I like the fact that the essay questions are a mix of different aspects of the course”.

If named examples are required in an answer the examiners are reminded to search for any example they have not heard of to check the example is being correctly used.

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

Candidates did not always understand the requirements of different command terms such as outline, distinguish, explain, suggest, evaluate and compare and contrast. This may have resulted in many responses lacking the necessary detail and focus, with many answers given being too general and vague. Candidates frequently struggled to provide clear definitions of key ESS terms.

The construction of a flow diagram showing positive feedback proved problematic for most candidates. Knowledge and understanding of environmental value systems appeared to be very limited. The definition of an ecological footprint was generally poorly done. There was also poor understanding of the role of economic valuation in conservation. Naming two material inputs for photosynthesis was answered poorly. Examples are not always detailed enough – biomes are named instead of ecosystems and non-extinct organisms instead of extinct ones.

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

The candidates did not have problems completing the exam paper in time as there were few rushed/incomplete answers. The candidates seemed able to extract information and use information from the resource booklet effectively. There was a balance between how they answered section A and section B questions.

Overall candidates had a good understanding of:

- reasons for increase an in energy use;

- ways to reduce carbon dioxide emissions;
- the different roles NGOs and intergovernmental organisation have in trying to conserve biodiversity;
- reasons for species extinction and how intervention measures can be used to conserve species;
- range of environmental problems caused by food production systems
- Most candidates gave effective examples to illustrate answers; this indicates that case studies are being covered in class.

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

The case study is given for a specific biome, area of land or ocean/sea. This year the Pacific was considered and information/data about aspects of the Pacific Ocean were included in the resource booklet. Most candidates will not have been directly taught about the case study presented. Question 1 is designed for the candidates to apply the taught syllabus content in the context of the case study, which can be on environmental issue/current events. Certain parts of the case study may not be specifically on the syllabus, in the past the Indian Ocean Tsunami was used, continental shelves and HEP dams. This year the use of the El Nino/ La Nina oscillations and ocean currents were used where the candidates are expected to apply principles learnt and use their analytical skills.

1a(i) The majority of candidates correctly answered this question. But not with the most obvious answer of the sun. A significant minority gave plate tectonics, the moon, tides and gyres as the incorrect answer. Comments on the G2 form suggested that this was off the syllabus, however the information in Figure 5 of the resource booklet indicates “trade winds that blow air and warm surface water westwards” gave the answer of wind.

1a(ii) Common errors included listing types of plastic rather than the source of plastic or to provide vague answers e.g. domestic waste. Also listing countries surrounding the Pacific as the sources for the plastic waste, this is incorrect.

1a(iii) Responses varied widely with some very well focused answers. Incorrect responses included the use of mark, release and recapture method. The most common type of answer involved a quadrat/area sample and then multiplying the average for the whole area of the gyre. The candidates were expected to apply their knowledge of measuring abiotic and biotic factors in an ecosystem to this question.

1a(iv) Some very good responses were achieved for this question, with many candidates achieving between 2 and 4 marks. Frequently the evaluation was missing from this response or candidates only focused on recycle, reuse and reduce.

1b(i) A common error was to state that the chicks were poisoned rather than focusing on why the chicks could starve. However most candidates mentioned blockage or lack of nutrients for the mark.

1b(ii) The majority of candidates achieved some marks for this question, marks were frequently lost for the lack of clarity or/and detail. The terms biomagnification and bioaccumulation are not required to gain the marks (this is stated in the syllabus), though many students did use these terms effectively. However, in some cases candidates confused the two terms.

1b(iii) Most candidates were able to state the purpose of the Red List. Those that did not focused on the Red List providing protection to species.

1b(iv) The majority of candidates performed well on this question. A common error was to state only one rather than two possible threats to albatross species. Also many gave the poisoning and oil pollution when these are both one marking point. The most common answer was drawn from Figure 3 in the resource booklet.

1c(i) Many candidates struggled with this question and some candidates made no attempt leaving a blank response. The mark scheme allowed a variety of responses recognising 9 events in 20 years (or 21 years), as seen from the number of distinct rises above the 0.5 line in Figure 6. Some candidates who gave a correct answer then went on to calculate a % which is incorrect, though the first answer was credited. Please guide candidates to expect calculations.

1c(ii) Most candidates achieved at least one mark for identifying larger populations as a reason for greater impact of El Nino and La Nina events. Few answers included an increase in intensity or frequency. Many gave long answers about the general impacts of El Nino and La Nina.

1d(i) A surprisingly large number of candidates did not identify water and carbon dioxide as the two material inputs of photosynthesis. Many gave light/sun which is an energy input. Some gave oxygen too.

1d(ii) Responses varied widely. Marks were frequently obtained for suggesting global warming/climate change and an increase in average temperatures increasing evaporation, deforestation was also popular.

1d(iii) There were few clear and focused diagrams. Many candidates identified logging/deforestation as a human activity and/or the increase in carbon dioxide leading to increase in temperature. Often responses lacked a feedback link and there were also a large number of blank responses. Many candidates tried to link drought into increased carbon dioxide without clear labels. Most gave diagrams that attempted to include arrows, a link to the Amazon and to the carbon cycle – many were not totally successful.

1e(i) & 1e(ii) Both these questions were well answered.

Essays. Questions 2 and 4 were most popular. Very few candidates opted to do question 3 which was also poorly answered. Question 5 was fairly popular.

2a This question was generally well answered, although some accounts lacked clarity. Most managed to mention an increase in population. Technology changes was also popular.

2b(i) There were some very good responses to this question. But many only gave one clear reason – usually global warming worries.

2b(ii) Answers varied widely. Often marks were lost for lack of clarity or detail and candidates did not always directly link the example to the way of reducing emissions. A common mistake was to include planting of trees as a way of reducing emissions of carbon dioxide. Also the combination of reduce fossil fuels and use renewables with no other detail was common.

2c Responses varied widely for this question, with some very good answers. A common mistake was to discuss the advantages and disadvantages of an energy source, rather than focus on the reasons for the choice being linked to economic/political/technology/ natural resources of the named countries. The choice of countries was varied - Africa is not a country and the energy examples

chosen did not match what the country actually uses. Candidates may have quickly thought of 2 contrasting countries and then imagined what their energy used was. Denmark having nuclear power for example.

3a and 3b Responses to these two questions were generally very poor. Candidates demonstrated very limited knowledge and understanding about anthropocentrism and technocentrism or other environmental value systems and their potential role in sustainable development. Many stated that anthropocentrism meant humans were more important than the environment, usually technocentrism was reduced to technology will solve all environmental problems.

3c This component was better answered, although in some cases candidates did not name an intergovernmental organisation or a non-governmental organisation. A few candidates named country level organisations as intergovernmental ones. Even with error carried forward they did not manage to usually answer the question. The candidates found comparing harder to do than contrasting. Many candidates gave excellent answers here.

4a Surprisingly few candidates provided a clear and succinct answer. A mark was frequently obtained for stating biotic is living and abiotic is non-living. Luckily most candidates gave an example for each factor to gain the other mark.

4b This question was fairly well answered by many candidates. Most candidates were able to successfully name an extinct species e.g. dodo and Tasmanian Tiger (Thlyacine) and provide valid reasons for their demise. Intervention methods frequently included banning hunting and use of zoos and captive breeding programmes. A minority gave non-extinct organisms like the clouded snow leopard, black rhinos and Arabian Oryx.

4c(i) Responses were often superficial, with many candidates predominately listing the range of goods and services, which in such cases limited marks awarded to a max of 3 out of 6. The use of a named ecosystem was also poor – most gave a biome.

4c(ii) A number of candidates struggled with this question and did not appear to be aware of the role of environmental economics in environmental conservation. Nevertheless, there were some very good clear responses.

5a Few candidates gave a clear and succinct response with many answers lacking clarity, especially for non-point source. The use of examples was also patchy, non-point source proved to be tougher to give an example for.

5b Responses varied widely for this question with some very good answers. Overall many identified a variety of problems although these were not always matched with appropriate solutions. Marks were frequently lost for lack of detail in describing either problem or solution. Many candidates had a tendency to give long detailed outlines for each problem, especially on eutrophication.

5c Many candidates struggled with this component. Few adequately defined ecological foot print or addressed both strengths and weaknesses of its application to water resources. Very few understood that an ecological footprint is a model.

Recommendations and guidance for the teaching of future candidates

Candidates should be encouraged to:

- read the exam question carefully and ensure they address the specific command term

and actual question being asked.

- attempt all components of the exam questions and not leave any blank responses.
- Draw large clear diagrams that are well labelled.
- Learn the definitions/terminology in the glossary.
- Practice the links between the topics, the course is designed to be holistic.
- practice past question papers and other questions that involve application of knowledge and understanding to different situations, including mathematical calculations.
- use the paper in the question booklet before asking for an extra booklet.
- avoid generalisations about areas of the world – generally about developing countries that are insensitive, for example: Africa is a country, most babies die there, technology does not exist and so no electricity is required. Within the teaching of ESS the overarching concept of international mindedness and global contexts must be considered.