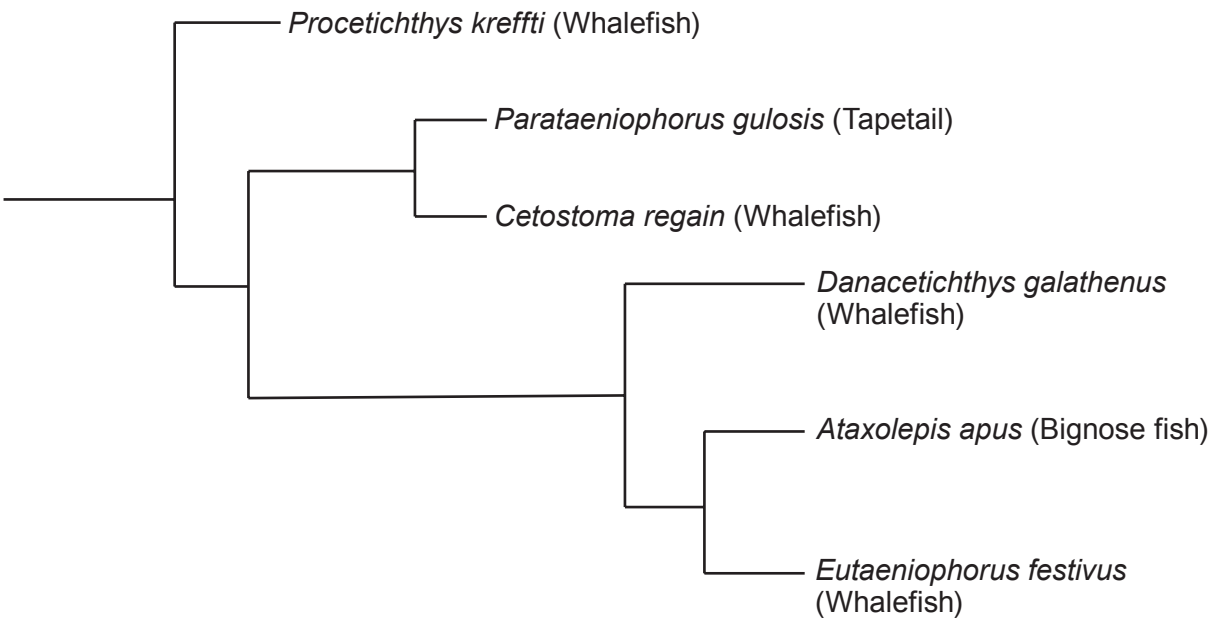
7. The deep regions of the oceans (1000 – 4000 m) are nutrient-poor habitats. In order to survive, the fish that live there have evolved remarkable morphological and life-cycle strategies. The larvae of many deep-sea species develop in the nutrient-rich surface waters (0 – 200 m). Very few specimens of these fish have been caught, which makes them difficult to classify. This illustrates the tentative nature of classification. The table below provides information on specimens of three types of deep-sea fish.

Type of Fish	Example specimen	Evidence
Tapetail		**Depth Caught:** 0 – 200 m **Number caught:** 120 **Size:** 5 – 56 mm **Age:** juvenile **Gender:** unknown **Feeding:** large numbers of animal plankton; mouth is upturned, jaws are small
Whalefish		**Depth Caught:** below 1000 m **Number caught:** 600 **Size:** 26 – 408 mm **Age:** adult **Gender:** all female **Feeding:** eat large prey; jaws are long and can open very wide to swallow prey whole
Bignose Fish		**Depth Caught:** below 1000 m **Number caught:** 65 **Size:** 34 – 68 mm **Age:** adult **Gender:** all male **Feeding:** do not feed; have a very large liver which acts as a store of energy and nutrients

Examiner only

Analysis of ribosomal RNA from examples which have been caught has produced the following phylogenetic tree.

Phylogenetic evidence



Two hypotheses have been proposed to classify these deep-sea fish:

Hypothesis 1: Tapetails, Whalefish and Bignose Fish belong to **different** families of fish.

Hypothesis 2: Tapetails, Whalefish and Bignose Fish are developmental stages of different species of fish within the **same** family.

For **each type of evidence** listed opposite and above, state whether they provide support for **hypothesis 1** or **hypothesis 2** and give reasons for your answers. From this evidence, conclude which hypothesis is more likely and suggest why a different conclusion may be reached in the future. [9 QER]

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Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
7	**Indicative content** **Use of table** • **Feeding evidence:** supports hypothesis 1, • {feeding / jaw} is different in each fish type suggesting three separate families/ if same family would expect same {feeding / jaw}. • **Gender evidence:** supports hypothesis 2, • the whalefish are all females, the bignoses are all males, the tapetails are all immature. • **Depth evidence** supports hypothesis 2 • the tapetails are all caught above 200 m whalefish and bignoses are caught below 1000m **Use of tree** • **Phylogenetic tree:** supports hypothesis 2, • the ends of the branches of the phylogenetic tree have different types of fish grouped together/ Whalefish are on more than one branch - E.g. Tapetails and whalefish at the end of the same branch in the top half of the tree. - E.g. Bignose and whalefish at the end of the same branch in the lower half. • If they belonged to 3 separate families the ends of the branches would have only whalefish, bignoses or tapetails together at the ends of the last branch. **Conclusion and future change:** • Hypothesis 2 more likely because it is supported by both table and phylogenetic {evidence/ tree}. • The feeding evidence does not rule out hypothesis 2 because different developmental stages could have different feeding mechanism. It might change in future if a larger number of specimens became available.	2			2		

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks Indicative content of this level must include Detailed evidence from table Detailed evidence from tree Conclusion *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately* **4-6 marks** Indicative content of this level Any two from Evidence from table Evidence from tree Conclusion *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content Either basic evidence from table Or basic evidence from tree *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
	Question 7 total	**0**	**5**	**4**	**9**	**0**	**0**