1. $P_i = \overbrace{10 + 3Q_i}^{MC_i} \quad P_i = \overbrace{170 - Q_i}^{MWTP_i}$

a) Period doesn't matter, so $P = 10 + 3Q$, $P = 170 - Q$

$10 + 3Q = 170 - Q \rightarrow \boxed{Q^* = 40} \; \boxed{P^* = 130}$

b) $MWTP_1 - MC_1 = \frac{MWTP_2 - MC_2}{1+r} \rightarrow (170 - Q_1) - (10 + 3Q_1) = \frac{(170 - Q_2) - (10 + 3Q_2)}{1 + 0.10}$

$160 - 4Q_1 = \frac{160 - 4Q_2}{1.1} \rightarrow 176 - 4.4Q_1 = 160 - 4Q_2$

Recall $Q_2 = 50 - Q_1 \rightarrow 16 - 4.4Q_1 = -200 + 4Q_1$

$216 = 8.4Q_1 \rightarrow \boxed{Q_1^* = 25.71} \; \boxed{Q_2^* = 24.29}$

$P_i = 170 - Q_i \rightarrow \boxed{P_1^* = 144.29} \; \boxed{P_2^* = 145.71}$

c) $Q_1 = 25.71 \quad Q_2^* = 40 - 25.71 \rightarrow \boxed{Q_2^* = 14.29}$

But if they had known there were only 40 tonnes of Zhemchuzhnikovite before the first period...

$MWTP_1 - MC_1 = \frac{MWTP_2 - MC_2}{1+r} \rightarrow 176 - 4.4Q_1 = 160 - 4Q_2$ (as in part a))

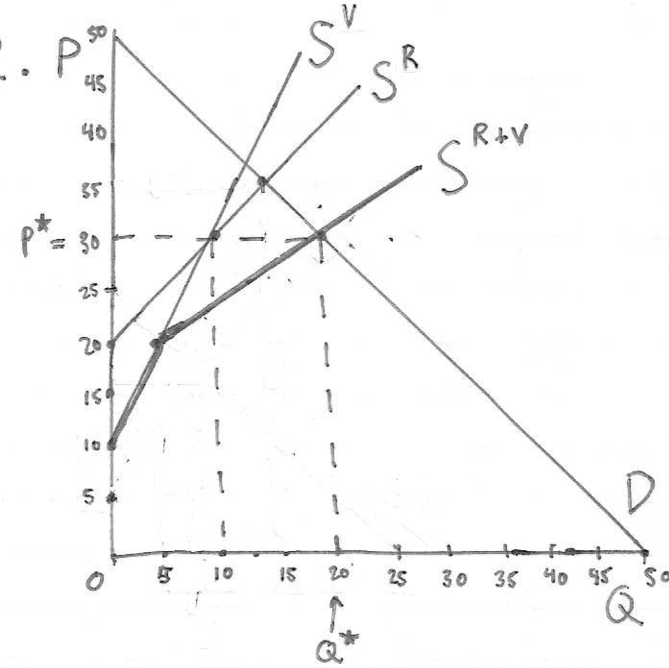
But $Q_2 = 40 - Q_1$

$\rightarrow 16 - 4.4Q_1 = -160 + 4Q_2$

$176 = 8.4Q_1 \rightarrow \boxed{Q_1^* = 20.95} \; \boxed{Q_2^* = 19.05}$

Q_1 is higher and Q_2 is lower when the company miscalculates the known stock.

d) Possible answer: To maximize net benefits, the discounted net benefits should be the same in each period. Q_1 is chosen in terms of what Q_2 will be. In part b), $Q_1 = 25.71$ and $Q_2 = 24.29$ ensure that $(MB_1 - MC_1) = (MB_2 - MC_2)$ when $Q_1 + Q_2 = 50$. But in part c), the company must reduce Q_2 by 10, resulting in $(MB_1 - MC_1) < (MB_2 - MC_2)$. In the second part of c), the company is choosing Q_1 and Q_2 so that $(MB_1 - MC_1) = (MB_2 - MC_2)$ when $Q_1 + Q_2 = 40$

2. 

$D: P = 50 - Q$

$S^R: P = 20 + Q \rightarrow Q_R = P - 20$

$S^V: P = 10 + 2Q \rightarrow Q_V = \frac{P}{2} - 5$

$S^{R+V}: Q = Q_R + Q_V = \frac{3}{2}P - 25 \quad (Q \geq 20)$

By horizontal summation

b) When S = D

$\frac{3}{2}P - 25 = 50 - P$

$\frac{5}{2}P = 75 \rightarrow P^* = 30$

$Q^* = 50 - 30 = 20$

$Q_R^* = 30 - 20 = 10$

$Q_V^* = \frac{30}{2} - 5 = 10$

Recycling ratio $= \frac{Q_R^*}{Q_V^*} = \frac{1}{1} = \boxed{1}$

c) Recycling ratio = 0 when $Q_R^* = 0$

$\therefore 0 = P^* - 20 \rightarrow \boxed{P^* = 20}$

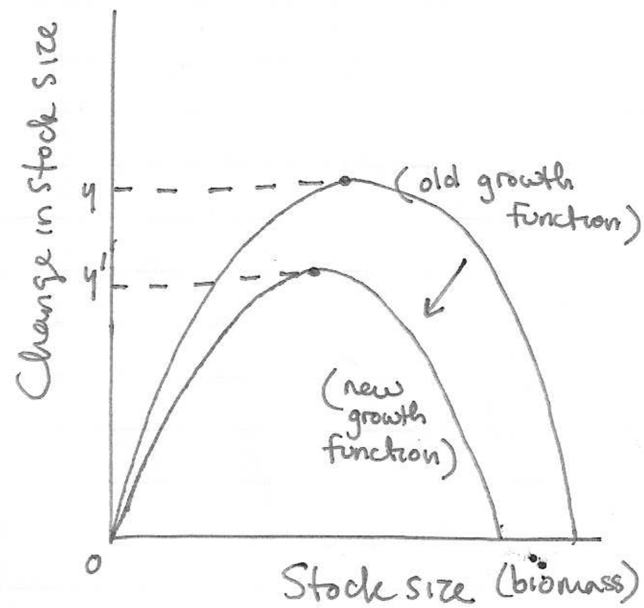
d) • Investment in recycling industry decreases
• Subsidies on virgin materials

(Pretty much anything that $\downarrow S^R$ or $\uparrow S^V$)

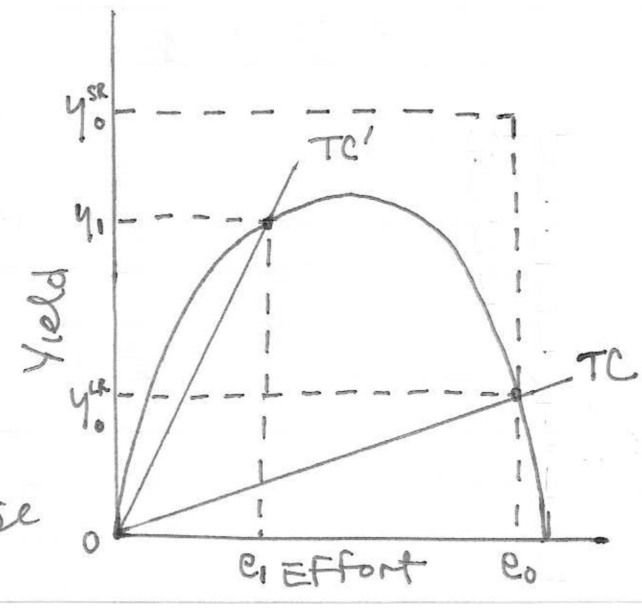
See "The Economics of Recycling" in your textbook

3. Overfishing does not affect the shape of the curve. Environmental factors will "collapse" the

a) curve (see figure)



b) If the fishery is at $S_0 > S_1$, any yield between 0 and b is sustainable. Therefore, the annual yield y^* must be exceeding b ($y^* > b$). In the first year, this reduces the stock below s_1, and it never has a chance to repopulate to s_1 by the next period. Eventually the stock converges to zero.



c) Possible answer: Overfishing results in too much effort that gives a temporarily high yield that settles to an economically-inefficient long-run yield. The government can institute fishing regulations that increase the effective costs of the fishers as in the figure to reach a more sustainable outcome

4. a) False. See "Efficient Rates of Effort" in the textbook

b) False. See "The Problem of Open Access" in the textbook

c) False. See the shortcomings of regulations in "Approaches to Fisheries Management" in the textbook